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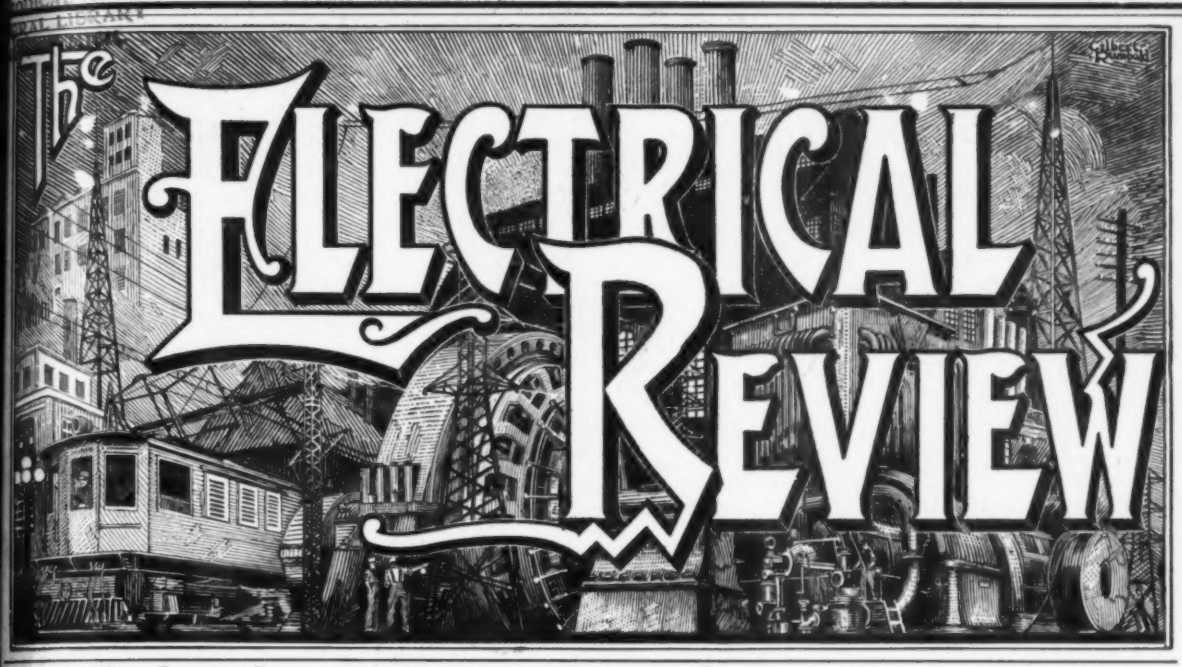

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Advertisement Index, see page xl. *Official Notices, see Sup. 48.*

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VOL. XCIII. OCTOBER 19, 1923. No. 2,395.

ELECTRICAL REVIEW.

Vol. XCIII.] CONTENTS: October 19th, 1923. [No. 2,395.

	Page
Grants for Making Work	561
The Institution of Welding Engineers	562
Manchester Electricity Undertaking	562
The Lesson of Austria	562
The Powers of the P.M.G.	563
Running-cost Calculations, by Major J. C. Connan	564
Electric Cranes, by Daniel Adamson	567
The Postmaster-General and Electrical Power and Lighting Undertakings: a Rejoinder, by W. H. Stoker	568
Government Assistance for Company Schemes	569
Austria's New Industrial Problems	570
Electrical Construction in Latin-America	570
Manchester Corporation Electricity Department	571
The Cycle and Motor-cycle Show	571
Correspondence:—	
Price Reductions?	572
The Prospects of British University Engineering Graduates in the United States	572
Quick-make-and-break Switches	572
Legal	572
Business Notes	573
Manchester Corporation Electricity Works (*illus.*)	579
An Electrically-equipped Harbour Jetty (*illus.*)	580
The Dundalk Electricity Undertaking (*illus.*)	581
Notes	585
City Notes	589
Stocks and Shares	589
Market Quotations for Chemicals and Metals	590
The British Association—VI	
Developments in Wireless Reception, by J. Scott-Taggart (*illus.*)	591
Vocational Tests for Engineering Trades	592
Population and Unemployment, by Sir William Beveridge	593
Analytical and Experimental Investigations Relating to Water Turbines, by Hubert Mawson	593
Exports and Imports of Electrical Goods and Machinery in September, 1923	594
The Institution of Welding Engineers	595
The Work of the Electricity Commissioners (*continued*)	597
New Electrical Devices, Fittings, and Plant (*illus.*)	599
New Patents	600
Published Specifications	600
Contractors' Column	Advertisement page xxviii

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GRANTS FOR MAKING WORK.

SIR PHILIP LLOYD-GREAME, speaking at the first meeting of the Imperial Economic Conference, referred to the Trade Facilities Act, and said that this was one of the measures—economically, he thought, the most sound—which the Government had designed for dealing with unemployment. Under that Act power was taken to give a Government guarantee to capital issues for works of different kinds. Sir Philip Lloyd-Greame explained that in that way they had accelerated the putting in hand of sound revenue-producing schemes, such as railway extensions and electrification which would otherwise have been delayed, and that they had thus secured immediate orders for our factories and had speeded up the development of useful undertakings, which, in their turn, would provide improved facilities and lead to further development.

The pronouncement thus made by the President of the Board of Trade is undoubtedly correct in a general sense. The Government guarantees mentioned have certainly assisted many industries, particularly the railway companies, which have come in for the lion's share. Assistance has also been given to the electricity supply industry, notably in the case of the London Electric Supply Corporation (£650,000) and the Shropshire, Worcestershire, and Staffordshire Power Co. (£700,000), as well as the Tata hydro-electric concern.

A certain number of smaller loans also were granted to electricity supply undertakings, but not to any very considerable extent. The conditions under which the guarantee was given were, in fact, made so severe that just those companies which would most have benefited were debarred from assistance.

As to the financial provisions, the limit of guarantees was fixed by the first Act at 25 million pounds. This was extended in December, 1922, to 50 million pounds, but up to the time of the issue of the last White Paper the major proportion of this second 25 million pounds was still intact, and, so far as we know, after the discouraging experience of the first Act, no electricity supply companies have tried to participate in this extended guarantee. It is still open, however, for companies to make application until December 15th, 1923.

The Government has now introduced another method of assistance. The latest proposal (in which electricity supply companies can participate) is through the Unemployment Grants Committee. This Committee, whose duties are described in the "Official Announcement" published elsewhere in this issue, is empowered to make grants to public utility companies for works which would afford employment during the coming winter and which would not otherwise be proceeded with at the present time. In this case the Government does not assist with capital, but helps in the payment of the interest on capital. The Committee can grant to such companies as it approves the payment of a maximum of 50 per cent. of the interest on the capital raised. This grant would only continue normally for the period during which the capital expenditure was not earning revenue. The Government is apparently a little bit cynical as regards the possible lack of *bonâ fides* of some applicants at least, since it also makes it a condition that the undertaking will normally be required to submit to such limitations as to the distribution of profits, &c., during the period of assistance "as may be necessary to secure, in the opinion of the Committee, that no undue advantage is taken of such assistance."

The terms and conditions might perhaps have been considerably better, since if there were more encouragement, it might affect a good many schemes in different parts of the country which might be pushed forward with great benefit to everybody concerned. The terms just offered to companies are an extension of the unemployment grants scheme designed primarily for municipal undertakings. In the case of municipalities, however, as we have already pointed out in our columns, the terms offered to their electricity supply undertakings are of a very different complexion. It is satisfactory to note from our news pages that many municipal authorities are giving very practical attention to the matter, and some have advanced substantial schemes for the approval of the Electricity Commissioners. It is possible that there may be a proportional difference between the way in which companies and municipalities avail themselves of the respective offers of the Unemployment Grants Committee.

Sir W. Joynson Hicks has this week outlined important bridge-building intentions which will assist the steel trades of the Kingdom if the cheap metal supplies lying ready for export from the Ruhr district are not admitted here.

When the Government meets after the recess it may have further proposals prepared, and possibly it will be in more generous mood as regards the conditions under which it offers encouragement. If public utility companies can assist in dealing with the problem of unemployment, it is surely to the advantage of the Government to secure their whole-hearted co-operation.

The fact remains, however, that there are large companies which are in such a prosperous condition that they can well afford to expedite their own local development operations without assistance from anybody. Undertakings which are not doing their utmost to push business in their areas of supply are not only doing an injustice to the nation by failing to do everything in reason to create employment, but they are acting unfairly toward their shareholders by going more slowly than they need to do with revenue-producing work.

The Institution of Welding Engineers.

Yet another technical institution has come into being in the Institution of Welding Engineers, whose first president is Sir Peter Rylands. As reported on another page, the new institution held its first ordinary general meeting at the Holborn Restaurant on Wednesday, October 10th, and the fact that there was an attendance of 150 to hear the presidential address and two papers on electric and gas welding respectively speaks well for the future. There has inevitably been raised the old criticism of the undesirability of forming new technical associations, but a change of opinion, speaking generally and not specifically, is taking place with regard to this matter. Not so long ago, some of those associated with the older engineering institutions expressed their disapproval of the multiplication of technical societies, but circumstances have proved rather too strong for this point of view to be maintained. The fact is that the older engineering institutions are unable to deal with specialised branches in the manner that new and progressive departments of engineering call for, and welding is certainly one of these. As a result, it has been stated by those prominently associated with what are often termed the parent institutions that the formation of specialist institutions should not be discouraged, always, we may add, with the idea of federation at some future time. The practical side of welding has developed in a manner tending to outstrip the advance of the scientific side, and an institution devoted specially to the problems involved is needed if welding is to take the place in industry which it deserves. The greatest need is for the application of scientific principles, and real progress in that direction could not be expected to be made whilst there was no organisation which could take in charge the many problems which arose. Outside the purely technical problems is the matter of training welders, concerning which some very hazy and loose ideas exist in the minds of many people. An urgent need in welding to-day is really efficient welders. We are too often told—perhaps as a result of war conditions—that an efficient welder can be trained in a matter of six weeks. In general, he cannot, and it will be one of the first and most important tasks of the Institution of Welding Engineers to devise a system of training which will stamp a welder as having ability of a recognised order. Without detracting in the least from the quality of the work now turned out by welders generally, it would be idle to suggest that further improvement is impossible, and with that improvement will come that greater adoption of welding which is urged by those prominently engaged in the industry to-day.

Manchester's Electricity Undertaking.

With the opening of the Barton power station of the Manchester Corporation Electricity Department a new era opens in the history of that remarkable undertaking. First set on foot by Dr. John Hopkinson himself in 1893, and developed by his pupil, Mr. C. H. Wordingham, first chief engineer at Manchester (who was present at the ceremony last week), who in 1896 recommended the adoption of three-phase generation at high pressure in one large power station, the department has been under the control of Mr. S. L. Pearce for some 20 years, and in that period has vastly extended its capacity and its responsibilities. Even in 1903 the undertaking was by far the largest and most important of its kind in this country, and it has since maintained its position at the head of the municipal undertakings.

A tour through the new power station gives one the impression that it is above all a first-class example of sound engineering, and the quality of the plant, all of British manufacture, is indicated by Mr. Pearce's announcement that the highest thermal efficiency recorded by the Electricity Commissioners in their recent fuel consumption report has been beaten at Barton. Another impression is that it has been a costly undertaking, and this is borne out by a remark of the chairman of the Electricity Committee, Ald. W. T. Dagnall, to the effect that out of the total capital outlay of 7¼ millions sterling, 2½ millions were debited to Barton. One has to pay a high price for efficiency—but "the best is the cheapest in the end," and we may be sure that Mr. Pearce and his colleagues have thoroughly weighed the matter from every point of view. If the new station can be kept running always at a high load factor, leaving the older plant to deal with peak loads, the capital charges will become a minor matter and the fuel economy will be of the first importance. The switchgear, operating at 33,000 volts, is of the cubicle type, and is of unique dimensions so far as this country is concerned, occupying (with the step-up transformers) a building almost as large as the turbine-room.

Since the work was put in hand, the South-East Lancashire Electricity District has been established, comprising an area of some 1,200 square miles; in the supply of this district Barton will play an important part.

Manchester now possesses generating plant aggregating about 209,000 kW continuous output, two-fifths of which is at Barton and is therefore of the most modern type. Our congratulations are due to Mr. Pearce and his staff on the splendid progress that the undertaking has made under his guidance.

The Lesson of Austria.

The success that has attended foreign intervention in the control of Austrian finance is admirably described in the report by Mr. O. S. Phillpotts, British Commercial Secretary at Vienna, which has just been issued by the Department of Overseas Trade, and is re-

ferred to in another column. It makes one wonder whether the collapse of Germany's financial system, which is now almost complete, might not have been obviated with equal success if a bold line had been taken and sound taxation and currency policies dictated and enforced at Berlin by the Allied interests.

Austria, it will be recalled, had found its budgetary problem insoluble. The excessive expenditure, chiefly on the salaries of the officials, could only be met by inflation, which increased the cost of living; under the index system the salaries automatically rose accordingly, and so on in the vicious circle which has similarly encompassed the German economic system in its deadly grip. The fear which inspired the Austrian Chancellor in his appeals to the Allied Powers and to his neighbours was that Austrian paper money would soon lose both its internal and external purchasing value, that famine and anarchy would supervene, that some of the neighbouring States would invade the country, and that it would ultimately be divided between them. Despite this threatened crisis, immediately the League of Nations was known to be tackling the Austrian problem seriously, the slide in the crown ceased, although during the succeeding two and a half months the note circulation was more than trebled. In Mr. Phillpotts's opinion this shows how largely the Austrian problem is really a psychological and administrative one, due to the want of confidence of the population in themselves and their Governments, and an almost unquestioning reliance on foreign help and foreign control. In this respect there is little analogy with the German situation. Germany's absurd and arrogant faith in her ruling classes is too firmly fixed to have been entirely shattered, although it has been greatly shaken. At the same time, she shows little sign of any desire for foreign control.

There is marked similarity in the unprofitable state into which the railways of both countries fell owing to the inflation of the currency. The wages of the railway employés were increased as the value of the currency fell in accordance with the index figures of the cost of living, but the railway tariffs were far below what they should have been on the same basis. Practically all the numerous Austrian State enterprises and monopolies were being run at a heavy loss. Under the control of Dr. Zimmerman, Burgomaster of Rotterdam, and nominee of the League of Nations, a comprehensive scheme of reform is being carried out, with the result that Austria has now one of the most stable currencies in South-Eastern Europe. One cannot but reflect that the financial *débâcle* in Germany might have been stayed if similar action could have been taken in Berlin before it was too late.

The Powers of the P.M.G.

In our last issue, Mr. S. C. Bartholomew, writing from the Engineer-in-Chief's Office, G.P.O., criticised the article by Mr. W. H. Stoker, K.C., which we published on September 28th; elsewhere in this issue Mr. Stoker deals with the few points—none of them important or essential—on which he is taken to task. Mr. Stoker is in no need of support from us, but we feel impelled to comment on certain features of Mr. Bartholomew's article, which appear likely to obscure the real questions that are at stake.

In the first place, Mr. Bartholomew refers in several passages to the regulations laid down by the Board of Trade, and provisionally adopted by its successors—the Electricity Commissioners—as though the existing regulations were like the law of the Medes and Persians. Those regulations, however, are not only capable of alteration, but are actually in course of revision; the Commissioners in their recent report state that the new regulations regarding the use of overhead mains are practically ready, and the redrafting of the regulations for "securing the safety of the public" has only been deferred on account of the greater urgency of the former, which certainly stood in great need of reform; and even in the existing regulations provision is expressly made for a circuit to be connected to earth for purposes other than that of carrying out the regulations, subject to the approval of the Board of Trade "with the concurrence of the Postmaster-General." There can be no shadow of doubt as to the power of the Electricity Commissioners to authorise the connection of a circuit with earth, in as many places as they please; the real question is: What right has the Postmaster-General to withhold his "concurrence"? The facts, quoted by Mr. Bartholomew, that the rules have been in force for many years, and that they only specifically call for one mode of earth connection, have no weight whatever; we are concerned not with what has been done in the past, but with what is best for the future.

Again, the fact that if and when the working of an electric line injuriously affects the lines of the Postmaster-General, the Commissioners may have to forbid its use, is a matter which concerns not the Post Office but the owners of the line; if they choose to accept the risk, that is *their* business, and the Postmaster-General has no more occasion to protect them against the consequences of their own acts than, as Mr. Stoker remarks, he has to ensure the safety of the public.

Mr. Bartholomew admits that, with alternating current, electrolytic action need not be feared. As regards the interference with telegraph circuits on railways, the "normal working" of an electric railway is very different from that of an ordinary power and lighting main, as the former is constantly liable to severe fluctuations of current. A reasonably steady flow of alternating current through the earth would have no effect on telegraphs, and a pure sine wave of 50 cycles frequency would not interfere with telephonic conversation, even in the unlikely event of induction taking place. Now, in the same issue in which we published Mr. Bartholomew's article, there also appeared an abstract of a paper by Dr. E. W. Marchant and Mr. T. H. Turney, in which simple means were described for ensuring that only pure sine waves should be sent out from the generating station, and Prof. G. W. O. Howe drew attention to the importance of this device in connection with the question of interference between railway and telephone circuits. There is already nearly 3,000 miles of single-phase railway in operation, and many countries have definitely adopted the single-phase system for the whole of their future railway electrification; obviously this would not have been done if the use of the system involved the dislocation of communications in the neighbourhood of the railways.

But we are not now concerned with railways, which are the most likely to produce interference, owing to the facts that telegraph and telephone lines are often carried alongside the tracks for many miles, and that the normal working conditions are the worst possible in this connection. The question before us is the use of the earthed return for power and lighting circuits, which do not necessarily parallel the lines of communication for long distances and are not liable to continual violent fluctuations of current. It should be remembered that under the existing conditions, in accordance with the regulations of the Electricity Commissioners, almost all a.c. systems are earthed at one point, and whenever an accidental earth occurs on such a system, there is a rush of current through the earth—a common enough occurrence on a large network. Is it alleged that this dislocates the telegraph and telephone service? On the contrary, Mr. Bartholomew states that on the extensive North-East Coast system multiple earthing is already allowed, and that in many districts earthing on consumers' premises is employed.

The Post Office, in fact, has no case against the use of the earth on technical grounds; and if we turn to the economic aspect of the subject, it has no right to oppose the adoption of methods which will enable a cheaper supply of electricity to be given in rural areas—a most urgent need, particularly in view of the importance of supplying farmers with cheap power.

D

RUNNING COST CALCULATIONS.

By Major J. C. CONNAN, B.Sc., A.M.I.E.E.

If a number of alternative tenders for an electrical installation are to be compared, it is not sufficient to consider these only from the technical or only from the price point of view, though naturally both of these are very important. It may be assumed that a tender which has been carefully thought out by the estimator will be technically sound, that is to say, that the most suitable apparatus, of the appropriate size for the work to be done, and correctly applied to meet the conditions of the installation in question, has been chosen. If this has been done, the tenders should not differ in price to any considerable extent, and assuming that no part of the work tendered for necessitates a heavy contingency item, such differences in price as do occur will usually be due only to variation in the make of apparatus put forward. Under these circumstances, therefore, it is always of interest to the prospective purchaser to know the running costs for the proposed alternatives. The running costs of any installation are usually calculated on the basis of a year's operations, and are made up of two parts:—

1. Indirect running costs.
2. Direct running costs.

In item 1—indirect running costs—are included all those items, such as interest on capital, depreciation of plant, repayment of loan, insurance, superintendence, &c., which remain approximately constant, and are more or less independent of the amount of work done by the plant. Whereas the direct running costs include such items as repairs, maintenance, labour, energy, &c., which are variable and in amount depend on the extent to which the plant is in operation.

Indirect Running Costs.

1. *Interest on Capital.*—The tender will usually be priced in sections, and it is therefore first necessary to put them together in order to arrive at the total capital outlay.

The tenders should be scrutinised, during the abstraction of these prices, to see that no important items necessary to the satisfactory operation of the installation have been omitted, and that the tenders are on a strictly comparative basis, which of course they will be if prepared to a specification.

If the firms have been allowed to make their own choice in putting forward plant, it is important to note that the final aim, such as a specified intensity of illumination on the working plane in the case of a lighting installation, or so many h.p. at a certain speed in the case of a power plant, must be the same for all tenders. If this is not the same in all the quotations, the working costs cannot be directly compared unless certain allowances are made to compensate for the differences. What the allowances will be depends entirely on the circumstances of the case, and cannot be dealt with here.

The interest allowed on the capital cost of the complete installation is usually that current at the time for industrial loans in the open market, and a guide as to this figure can usually be obtained from the financial section of any daily newspaper.

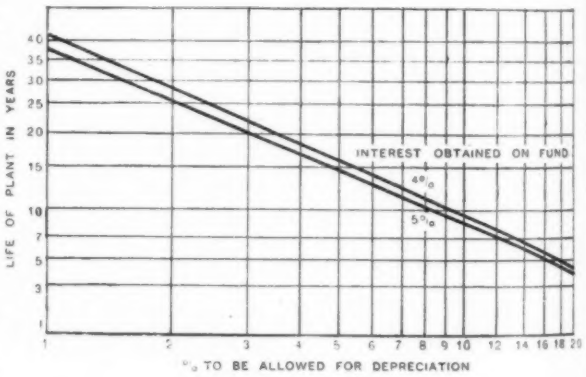
2. *Depreciation of Plant.*—As the plant wears out or becomes obsolete, it is necessary to replace it if the installation is to be kept in its sound initial condition. The percentage of the capital which should be put aside each year for this purpose will depend on the assumed life of the plant in question, on the amount obtainable when sold as scrap, and on the interest which is obtained on the accumulating reserve fund so formed.

The efficient working life assumed for the plant will be greatly influenced by the class of material employed in the first instance, on the care taken of the plant, and on the policy of the directors. The directors may assume, for example, that it is a sound policy from their point of view to put in cheap material, to run the plant at its highest rate, wear it out quickly, and replace it in a few years, thereby getting the benefit of any improvements brought out since the original plant was put in.

The following figures, therefore, are given as a guide only, and may be modified to suit the views of the customer.

	Average life.	Scrap value %.
Buildings	50 years	... 10
Motors	25 ,,	... 30
Accumulators	12 ,,	... 20
Switchboards	10 ,,	... 10
Transformers	30 ,,	... 30
Cable (in ground)	30 ,,	... 30
Switches	10 ,,	... 10
Controllers	10 ,,	... 10
Overhead lines	10 ,,	... 50
Steel masts	25 ,,	... 10
Concrete masts	30 ,,	... 10
Wooden masts	10 ,,	... 10
Shafting	30 ,,	... 20
Belts, ropes	4 ,,	... 15
Wiring generally (in buildings)...	15 ,,	... 10

The amount on which depreciation is to be allowed, *i.e.*, the original amount less what can be obtained for the scrap, and the number of years in which the fund is to accumulate, having been fixed, the percentage to be allowed on the capital outlay may be found from the following curve.



Depreciation Curve.

3. *Repayment of Loan.*—If the capital employed in the installation has not been taken from the business in which the installation is at work, but has been borrowed from the outside market, it is necessary to arrange for the repayment of the loan. The manner in which this will be paid back will depend on the conditions under which the money was borrowed, and may occur in a fixed sum every year for a certain number of years, varying amounts spread over several years, or a definite proportion of the gross profits. Whichever method is employed, a certain sum should be included under running costs.

The fact that this loan is being paid back does not affect the amount on which interest is to be calculated under item 1, for all that is occurring in the repayment of this loan is the transference of the loan from the outside market to the business in question. The money employed in repayment would otherwise be for investment outside, and would then bear interest; therefore when employed in the business it should also be put down for interest.

4. *Insurance.*—Under this head is to be included the annual premiums to be paid on the insurance of the installation in question. The premium will depend on the insurance office and the conditions under which the

installation is insured, and must be separately fixed for each case.

5. *Superintendence.*—This item should include the salary of the works engineer, or such portion of it as can be fairly assumed to represent the amount of time which he has to devote to the superintendence of the installation under consideration.

Direct Running Costs.

These costs are very largely dependent on the extent to which the plant is in operation, and it is first necessary therefore to decide on what may be assumed to be the equivalent number of hours per annum in which the plant will be running at full load. This is exceedingly difficult to do with any degree of precision, as the conditions under which the plant will be operated, even for the same class of business, are very variable. But experience will act as a rough guide, and even if the figures assumed should eventually be found to be incorrect, it will not greatly invalidate the present comparison, if the same figure has been used in the calculation of the running costs for each of the alternative tenders. The following data may be of some use in this connection:—

Full Load Running Hours per Annum for Lighting Installations.

Churches, schools, museums	150
Private residences	250
Theatres	300
Store rooms	350
Hospitals	350
Banks	400
Offices	450
Shops	500
Post offices	500
Hotels, restaurants	700
Machine shops	1,000
Telegraph offices with night work ...	1,200
Railway stations	1,500

Full Load Running Hours per Annum for Small Power Installations.

Café	350
Wagon repair shop	400
Boot repair shop	450
Mineral water factory	450
Baker	450
Tailor	500
Lift	600
Butcher	650
Book binding	750
Book printing	900
Paper box factory	1,000
Brewery	1,000
Fitting shop (repair shop)	1,000
Laundry	1,200
Wood working shop	4,000

1. *Repairs.*—This item covers the expense, exclusive of that incurred for lamp renewals and brushes for motors, necessary to keep the installation in running order. In such installations when the repair work is done by an outside firm, this item should include the cost of the labour and material expended on the repairs in question. But when the installation is sufficiently large to warrant the employment of a staff of electricians, only the cost of material should be included here, labour being charged to item 3 below. The amount required each year to effect the repairs is usually a varying one, growing larger as the plant becomes older, and will be greatly influenced by the quality of material used in the first instance, the supervision given while the plant is being erected and the care taken of the plant once it is running. It is only common sense to expect that an installation employing cheap material of poor quality, carelessly erected, will occasion a good deal more expense for repairs than one of high quality material, efficiently put together.

In deciding on what figure to include under this item, therefore, the tenders should be scrutinised particularly with regard to quality. For example: Is 600 or 2,500 meg. grade cable used? Are o.b. switches and good quality fuses employed? Are high-speed or low-speed motors offered, &c.?

From what has been previously said, it can be easily seen that it is extremely difficult to fix a reliable figure for the cost of repairs. It is customary to take a certain percentage of the capital cost of the installation (excluding the cost of incandescent lamps) which as a rule is not varied, a fund being allowed to accumulate during the first few years when the expenses are low.

This allowance usually varies between 2 and 5 per cent., the smaller figure being approached for high quality installations or medium grade installations which have few running hours, and the larger figure when the installation is of poor quality, or of good quality but used to its maximum capacity.

2. *Maintenance.*—Under this head is included the replacement of incandescent lamps as they are burnt out or the end of their economical life is reached, the replacement of mercury-vapour tubes or quartz tubes, the renewal of carbons in arc lamps, and renewal of carbon brushes in motors.

The life of vacuum and gasfilled lamps (tungsten) used to be guaranteed at 1,000 hours, but this has not in every instance been maintained. This is brought out by a recent correspondent of the Electrical Review, who states that the average life for vacuum lamps is 100 hours and for gasfilled 200. These appear very low; more reasonable figures would be 500 and 800 hours respectively. Mercury-vapour glass tubes usually last well above the 1,000 hours, the average life being round about 2,000 hours, some reaching as much as 7,000 hours. Mercury-vapour quartz tubes generally do not have such a long life as the glass tubes, being worked at a very much higher temperature, but usually reach their guaranteed life. In putting in a figure for the replacement of quartz tubes, it should be remembered that the manufacturer will usually allow a certain amount for the old tubes.

The cost of carbon renewals will depend on the type of lamp being used; open ordinary carbons, open flame carbons, enclosed plain carbons, or enclosed flame carbons. The tender should always state the size of carbon (length and diameter), quality of carbon, average burning hours per pair, and cost of carbons. To the total quantity of carbons required for the specified number of burning hours calculated on the burning hours given for one pair, 10 per cent. should be added to cover unburnt ends, breakages, &c.

The life of a set of carbon brushes depends on the quality of carbons used, the speed of the commutator, and the pressure of the brush on the commutator. As these differ for nearly every type of motor on the market, it is quite impossible to give any data which could be reliably used. As a rule, this item, when compared with other items of running cost, is comparatively small, and may in most instances be neglected. If it is desired to include it, the firm offering the motor should be requested to state the average life of a set of brushes.

3. *Labour.*—This item should include the wages of all electricians employed solely in looking after and maintaining the installation under consideration. If the installation is small and the whole of the time of an electrician cannot be employed on its maintenance, then only such portion of his wages should be included as will fairly represent the time he spends on this part of his duties, which will also include the time spent on repairs as well as that spent on maintenance.

If all repairs are done by an outside firm and only a non-electrician employed to trim arc lamps, the amount to be included for his wages may be obtained by assuming that an efficient man will replace the carbons and clean the globes of 15 lamps per hour, provided the lamps are not too far apart.

In all installations, particularly where there is much dust, the lamps and shades of incandescent lamps should be kept clean, as otherwise the output of light is greatly reduced. Some firms with very large installations employ a staff of women to periodically clean lamps and shades, usually once a month. The time required for this work will depend on the type of shade used, holophane usually taking longer to clean than plain, but a

figure which will cover all types of shades, direct, semi-direct, or totally indirect, allow care to be taken so as not to break the shades, and include removal of lamp and shade, washing both, drying both, and replacing both on pendant, is 10 minutes per lamp.

4. *Oil and Waste.*—This, of course, only comes in question in the case of motor installations. If a good quality oil is used, waste avoided, used oil whenever possible refiltered, this item can be covered by ca. 2 per cent. of energy cost, as given in item 5. It will usually be somewhat greater in small installations, and the above figure should therefore be increased when a large number of small motors are employed.

5. *Energy.*—Before the cost of this item can be calculated, it is necessary to know the rate of energy consumption. This is at once fixed by the type of lamp employed being ca. 1-1.2 W/c.p. for vacuum tungsten lamps, 0.5-0.6 W/c.p. for gasfilled tungsten lamps, 0.9-0.6 W/c.p. for open plain arcs, 0.5-0.25 W/c.p. for open flame arcs, depending on colour of light, 1.0-0.75 W/c.p. for enclosed plain arcs, 0.25-0.20 W/c.p. for enclosed flame arcs (all arc lamp figures include losses in resistance); 0.5 W/c.p. for mercury-vapour glass tube lamps, 0.2-0.25 W/c.p. for mercury-vapour quartz tube lamps. Whenever possible the figure given by the manufacturer should be used in preference to the average figures quoted above.

In the case of motors, the rate of energy consumption can be found from motor size and efficiency. If the latter is not given, it may be approximately allowed for by multiplying h.p. by 850, this giving the rate in watts. Always use exact figures given by the maker when possible.

Other items of running cost may be included, such as accident insurance for workmen, rent and taxes on any buildings taken specially for the installations, and a percentage of overhead charges of factory to cover office expenses. This need only be taken into consideration, however, in very large installations.

In order to facilitate these calculations, ensure that no items are forgotten, and to enable the results to be compared at a rapid glance the following tables have been prepared. These refer only to lighting and power installations, but similar tables for other classes of installations can be readily prepared on the same model.

Lighting Installation.

Running Costs.	Estimate No.
No. of burning hours assumed.....	
Average life of lamp assumed, in hours.....	
Working life of the wiring assumed, in years.....	
Particulars of Carbons to be used. " × ".	
Intensity of Illumination provided on working plane, in ft. cdls.....	
Total output of light provided, in lumens.....	
Total floor area lit, in sq. ft.....	
Indirect Costs.	
Interest on Capital. % on £ ...	
Depreciation of Plant. % on £	
Repayment of Loan	
Insurance	
Superintendance	
Direct Costs.	
Repairs. % on £	
Maintenance	
Labour	
Energy. kWh @ per kWh ...	
Total Annual Running Costs	
Running Costs per hour	
Running Costs per lumen-hour	

Motor Installation.

Running Costs.	Estimate No.
No. of working hours assumed.....	
Load Factor assumed.....	
No. of motors.....	
Total rated output of motors in h. p.....	
Working life of the motors and starters assumed.....years.	
Working life of the wiring assumed, years.....	
Indirect Costs.	
Interest on Capital % on £ ...	
Depreciation of Plant % on £	
Repayment of loan	
Insurance	
Superintendance	
Direct Costs.	
Repairs % on £	
Maintenance	
Labour	
Oil and Waste	
Energy kWh @ per kWh ...	
Total Annual Running Costs	
Running Costs per hour	
Running Costs per h.p.-hour	

The last items on each sheet, *viz.*, running cost per lumen-hour or per h.p.-hour, is an endeavour to provide a figure which may be compared for each tender. The smaller the figure the more economical would the installation be, but for this statement to be accurate in the case of a lighting installation, the intensity of illumination on the working plane (assumed at 2 ft. 6 in. from floor for all tenders) must be the same for all the alternatives put forward.

In conclusion, it cannot be too strongly emphasised that these calculations are only of value when honestly prepared, and for this reason should always be made by the consulting engineer, or in the case of small installations by the works engineer. Almost any figure for the running costs can be obtained by a suitable choice of the percentages to allow for interest, depreciation, and repairs, &c., and consequently unless these have been consistently chosen by one man after taking into consideration the variations in the material put forward, the results cannot be directly compared.

Vulcanised Fibre.—As most of the vulcanised fibre and "Leatheroid" made is unsuitable for electrical purposes, or is suitable only for particular applications, a need exists for studying the properties of such materials so as to be able to discriminate between suitable and unsuitable ones. A large amount of experimental work has been carried out, directed towards the development of methods of testing, and this will form the subject of a detailed report by the British Electrical and Allied Industries Research Association. Meanwhile the Association recommends the methods described (Ref. A/S4) in the September issue (Vol. 61, No. 322) of the *Journal* of the I.E.E. for the full study of this class of material, but it is realised that some of the tests are too elaborate for use as acceptance tests for the purchase of vulcanised fibre, and the British Engineering Standards Association has therefore been asked to issue a purchasing specification in which reference will be made to such of the tests as are suitable for the purpose.

Educational.—The Naval authorities at Devonport are inaugurating, on November 1st, a series of vocational training classes for ratings who are shortly leaving the service on pension. The classes will be held for two hours in the evening and the respective courses will extend for varying periods from two weeks to eight months. They include internal combustion engines, acetylene cutting and welding, electric welding, and a general electrical course. The classes will be held at the mechanical repair establishment at the naval barracks at Devonport and in H.M.S. *Defiance*.

ELECTRIC CRANES.

By DANIEL ADAMSON, M.I.E.E., M.Inst.C.E., &c.

The duty expected from electric cranes varies considerably according to the situation for which the crane is required, *e.g.*, some cranes are used at rare intervals, such as those installed in power houses, which are called upon only when repairs are to be made. The apparatus of such cranes must therefore be simple, so as to call for a minimum amount of care in maintenance, and yet reliable, because they are only used in times of extreme urgency, however infrequent these may be. The control, however, must be accurate, because they would generally be operated by men less skilled than if the cranes were in more regular use.

A second class of cranes comprises those installed in machine shops and foundries, which are in continuous operation throughout the whole of the working day, but are not usually loaded up to the full nominal capacity. The operators being generally more experienced, the mechanism must be designed for regular operation without demanding undue effort or execution on the part of the operator. The speeds of the various motions also require to be faster, in order that the time of the machines and the men on the floor may be saved.

Cranes in use in steelworks, working 24 hours to the day, generally under full load the whole of the time, must be of more robust construction, and the proportions must be more generous to ensure reasonable length of life and freedom from breakdown.

Direct-current motors are principally used for crane operation, but alternating-current motors are also installed when continuous current is not available. Direct-current motors should be entirely enclosed to exclude the dirt, yet the casing must be designed for accessibility.

Motors for cranes differ from those used for continuous working in that the crane motors require great mechanical strength in order to be ready to start frequently under full load. The commutator must also be designed to work under these conditions of frequent starting under heavy load. The electrical conductors of the armature and the strength of the magnetic field must be designed for sparkless working under these conditions, rather than for running for long periods without heating. One advantage of so designing the conductors of the armature is that the inertia effects are reduced when the armature is called to start up frequently. Sparkless running of the commutator is secured by using ample brush area, numerous commutator bars, and also by using interpoles.

With the modern requirements of control, using dynamic braking, or the "potentiometer" method or regenerative control, the motors must be designed to run sparklessly at high speeds. As crane motors are required to run equally well in either direction, this must take place satisfactorily without shifting the brushes.

All motors must have split frames, covers, and bearings to facilitate the removal of the armature especially as repairs are required to be carried out in the shortest possible time.

Motors are usually rated according to the temperature rise under a run at full load for a stated period. The usually expected limit of temperature rise is 90 deg. F. (50 deg. C.) above the surrounding atmosphere, in accordance with British Engineering Standards Specification No. 168-1923.

For power-house cranes, the usual time limit in which the above temperature rise may be attained would be 15 minutes; for machine-shop cranes, 30 minutes; and for steelworks cranes, 60 minutes.

Continuous-current motors for cranes are usually series-wound, which method gives a good starting torque under full load, and also allows high speeds to be attained with lighter loads, due to the inherent qualities of the series-wound motor.

In selecting the size of motors for various motions, it must be remembered that the hoisting motion has sometimes to lift heavier loads than it is usually intended for, while the longitudinal travelling motion and cross traverse motion may be called upon to drag wagons on the shop floor.

When alternating-current (polyphase) hoisting motors are called for, it is generally preferred to have these of the open type, because there is no working part corresponding to the commutator of the direct-current motor to be protected from dirt. Squirrel-cage motors are only suitable for handling rough material, when no control over the speed is required. When using alternating-current motors, the power supply must be maintained fairly uniform, because the maximum starting torque falls off very rapidly as the voltage varies. This is one of the disadvantages of the alternating-current when compared with the direct-current motor.

When cranes were slow in speed and of small lifting capacity, the brakes were not such an important item as they are at the present time. Longitudinal travelling motors on the earlier cranes were quite satisfactory without brakes, but now a foot-brake, or its equivalent, must be provided to be worked by the operator on cage-controlled cranes, or an electrically operated brake to work automatically when the crane is controlled from the floor.

Similarly with the hoisting motion, it was only thought necessary to provide a comparatively simple or meagre brake, but as loads and speeds increased, the electric brake had to be enlarged correspondingly, and more recently it has been necessary to devise some means by which heavy or light loads can be hoisted or lowered as delicately as required and with confidence.

This problem was first apparent with steel ladle cranes for steelworks handling large ladles full of molten metal, a failure on which would have serious, even fatal, consequences, or would at least delay production.

To meet this requirement, what were called "mechanical load" brakes were adopted. The principle of this brake was that though the hoisting motion was quite free in the lifting direction, numerous pawls or ratchets came into operation when lowering, and through the action of the frictional surfaces of the brake, the load on the hook could be lowered at a speed corresponding with the amount of movement given to the hoisting motor. In other words, the load had to be driven down, and was therefore under the control of the operator as much as when lifting.

These mechanical load brakes were, however, troublesome in some instances, because of the wearing of the brake surfaces and on account of the heat generated by the braking action.

Recently further improvements have been made in the controlling arrangements, whereby the load can be handled at any desired speed by manipulation of the controls and the mechanical load brake done away with.

The various methods of electrical control for continuous current are, or have been, as follows: Plain series, diverter, rheostatic, dynamic, potentiometer, and regenerative. (The control of a.c. crane apparatus deserves a separate article.)

Plain Series Control.—Controllers giving plain series working in both directions are quite satisfactory in the majority of shops, where very delicate handling of the load is not required, or in conjunction with mechanical load brakes on cranes of over 20 tons capacity, when the load can be controlled in the lowering direction as effectively as when hoisting.

Diverter Control.—Additional low-speed points can be added to the controller in both directions for cranes engaged on foundry work, for the delicate handling of moulds and patterns. This is effected by means of a resistance connected

in parallel with the armature of the motor on the low-speed points; thus the series field becomes separately excited.

Rheostatic Braking.—One of the earlier developments from plain series control was an arrangement of connections by which the surplus energy of the falling load was absorbed in resistances. This was wasteful, and was soon found objectionable for other reasons.

Dynamic Control.—Controllers for ladle cranes in steelworks usually have plain series control with two low-speed points (diverter control) on the hoisting side, and in the lowering direction the first few points are arranged to give a braking effect, the last two points being "power" points. This type of control is preferred when the load on the hook tends to overhaul the motor. The connections are so arranged that braking is obtained dynamically by the armature being connected to the line while lowering loads and having its field separately excited. Any tendency to an increase of speed by the gravitation of the load tends to make the armature voltage higher than that of the line and return the power thus generated to the system, a small proportion being absorbed in the controlling resistance. The "power" points are only used to drive down the empty hook or light loads. It will thus be seen that a moderate load (such as the weight of the empty ladle) will overhaul the motor, which will act as a generator and attain ample speed before the power points are reached, at the same time effecting a saving in current.

Potentiometer Control.—These controllers usually give plain series control with two low-speed points (diverter control) when hoisting, and the connections are so arranged that, when lowering, every point of the controller is either a power or a brake point, depending upon the load on the hook. One of the advantages of potentiometer control is that the controller gives an almost definite speed on any particular point whether motoring or generating; a better and more delicate control is obtained, and the heaviest loads can be safely lowered at full speed and gradually brought to rest. All the above controllers are used in conjunction with series-wound motors.

Regenerative Control (with Compound-wound Motors).—Another form of control is that for use with magnet cranes, where loading and unloading scrap iron, &c., has to be carried out in a minimum of time and where delicate handling of the load is not required. The controller gives plain series working in both directions. The motor is a special compound-wound machine, and is connected in such a manner that when lowering with the handle of the controller in the full "on" position, the motor acts as a generator and returns current to the line, at the same time limiting the speed to a predetermined figure. This type of control is not suitable for ordinary use, such as is required in the majority of shops.

Crane Protective Panels.

The protection of motors and controllers on cranes by means of switches and fuses has been superseded to a large extent in recent years by crane protective panels. These comprise an electrically-operated contactor-type circuit-breaker controlling all the main supply lines to the motors, and relays provided for protection against overloads. These panels are so arranged that in the event of the circuit-breakers opening circuit because of overload or voltage failure, they can only be reset by returning all the controlling handles to the "off" position. This arrangement necessitates extra contact rings in the controllers, and can only be fitted where provision has been made for it.

Contactor Panels.

With cranes involving larger powers than can be handled by a manually operated controller, contactor panels are used which enable the motions to be efficiently controlled through a small master controller, which merely handles the current passing to the shunt coils operating the contactors. The indirect advantages found from the use of properly arranged contactor panels of large cranes and also on other similar machinery driven by electric power, which are to be frequently stopped and started, are (1) a great reduction in the peak loads of the motor, resulting in a saving in the consumption of energy, the contactors being set to limit the current and rate of operation of switching-in, and thus, while allowing the maximum rate of execution of the work, yet preventing unnecessarily high current passing the motor and controller, which has been found in large works to make a remarkable reduction in the demands upon the power house; and (2) the motor, &c., being protected from these high currents is found to benefit accordingly.

THE POSTMASTER-GENERAL AND ELECTRICAL POWER AND LIGHTING UNDERTAKINGS: A REJOINDER.

By W. H. STOKER, K.C.

It is a matter for congratulation that Mr. S. C. Bartholomew has replied to the article under my name appearing in the Electrical Review of September 28th. Mr. Bartholomew is on the staff of the Engineer-in-Chief of the Post Office, and his contribution may be taken as evidence that his department, though perhaps a little sensitive to criticism, is now open to frank discussion. There are, however, some points in it which necessitate reply by me.

Mr. Bartholomew prefaces by proposing to point out what he says seem to be inaccuracies on the legal side of my article, and he quite correctly states that the amendment of Section 26 of the Electric Lighting Act, 1882, was effected by Section 25 of the Electricity (Supply) Act, 1919, and not by the Electric Lighting (Clauses) Act, 1899; but there the inaccuracies appear to end, so far as actually pointed out by him. The error was a clerical one, and does not really affect the matter, as indeed Mr. Bartholomew admits, and the amendment itself is not material to the present discussion. Mr. Bartholomew's further references to the law serve rather to emphasise the points urged in my article than to meet or displace them. Indeed, his reference to the necessity for securing "the safety of the public" seems to suggest that the Postmaster-General does in point of fact conceive a rather wider scope for his activities than is imposed on him. The responsibility for the safety of the public is not with the Postmaster-General, but with the Electricity Commissioners, who may safely be entrusted with it.

As regards the statutory notices referred to, I was bound to call attention to them, to the possibility of their being served, to their effect, if served, and to the consequent position of undertakings working under the provisions of a licence, order, or special Act. If in point of fact the Commissioners do not in practice serve these notices, so much the better for the undertakings concerned, but they manifestly have to have regard to the fact whether such notices have or have not been served, and it can scarcely be termed a waste of time for them to ascertain all factors bearing on the working of their undertakings.

Mr. Bartholomew suggests that the effect of Section 69 of the Electric Lighting (Clauses) Act, 1899 (termed by Mr. Bartholomew "The Electric Lighting Act, 1899"), has been overlooked, but this is by no means the case. This enactment refers to the powers of the Electricity Commissioners, and not to those of the Postmaster-General. Here again there would appear to be a tenddency to confuse the functions of the Electricity Commissioners with those of the Postmaster-General.

I must also point out that Mr. Bartholomew, in taking exception, at the end of his article, to what he terms a lecturing of the Post Office, &c., has misread and also misquoted a portion of my article. The actual words were:—"It was never intended or contemplated that he (*i.e.*, the Postmaster-General) *should* stretch them to the extent," &c. Mr. Bartholomew's quotation is "*would*," which is a different matter, and would imply that the Postmaster-General had actually done so.

My statement was not a lecture, but an exposition and emphasis of the true powers of the Postmaster-General and their limit. Similar observations apply to Mr. Bartholomew's suggestion that I had accused the Postmaster-General of having acted arbitrarily and capriciously, as will be seen on reference to what I actually said in my article.

Turning now to some of the more technical aspects of the matter, and especially with reference to the Brighton Railway, Mr. Bartholomew refers to my statement that the Board of Trade had approved a 20-volt drop on the rails of this company, and adds that he does not think that this is correct, as no regulations were made by the Board for this single-phase system, although he believes a reference by Sir Philip Dawson in one of his papers might lead one to think that such a drop was approved. As Mr. Bartholomew stresses this very important point, I would like to refer him to the following quotation from p. 10 of Mr. Edwin Austin's standard work on "Single-phase Electric Railways":—

"It should be stated that in view of the fact that the electrolytic effects of alternating current are less troublesome than those of direct currents, the Board of Trade fixed the maximum permissible drop in the return circuit at 20 volts instead of 7 volts as allowed for electric tramways. An entirely insulated return circuit was, of course, out of the question, and, consequently, this limit of 20 volts had to be kept well in view when designing the feeding and distributing system."

It is worthy of note that the author in his preface expresses himself as greatly indebted to Sir Philip Dawson for help in describing the work carried out under his direction on the Brighton line.

I would like, in this connection, also to bring to Mr. Bartholomew's notice the following quotation from Sir Philip Dawson's work, published in 1905 (p. 434) on "Electric Traction on Railways":—

"It has been argued by some that alternating currents could not damage pipes, or other metallic circuits encountered in the ground, through electrolysis. Experience and experiments have shown that, although electrolytic damage is undoubtedly less than in the case of continuous current, it still exists, and there is little reason to doubt, therefore, that although the limits of drop might, for alternating currents, be considerably increased by the Board of Trade, possibly, even, to 50 or 100 volts, instead of 7, that some limit in this drop in connection with alternating circuits will undoubtedly be called for by the Board of Trade. It is, therefore, essential to ascertain how, in actual practice, this drop could be calculated in the case of a railway using single-phase alternating currents supplied to the trains by means of an overhead working conductor, the rails or other earth or metallic circuit serving for the return circuit."

Mr. Austin's book was published ten years after Sir Philip Dawson's work, and in the interval investigations and experiments no doubt led to the ultimate decision of the Board of Trade.

Referring to Mr. Bartholomew's statement that the report of the Joint Committee of the House of Lords and House of Commons, 1893, "lends no support to Mr. Stoker's case," it seems necessary to remind Mr. Bartholomew of the following resolution in the nature of recommendations agreed upon by that Committee:—

"The Joint Committee also agreed upon the following resolutions in the nature of recommendations:

"(1) The Committee, having regard to the evidence before them, are of opinion that it is not in the present state of electrical science to the interest of the public to insist upon electrical tramways using an insulated return conductor, and that such insistence would retard the development of electric traction.

"(2) The chief objections which have been urged before the Committee to an uninsulated return conductor are, first, the interference by leakage and induction with telephones; secondly, the interference by leakage and induction with railway signals; thirdly, the damage to systems of gas and water pipes by the action of leakage currents.

"(3) They are of opinion that the best known means of overcoming the first of these disturbances is by providing an insulated return conductor for the telephones, and they have the less hesitation in recommending this course as the evidence shows that telephone construction is already tending in this direction, and that better results are secured to the public by the use of a twisted metallic circuit insulated entirely from the earth.

Recommendation (3) appears to suggest the proper means of meeting abnormal happenings such as are referred to by Mr. Bartholomew.

It is true that the Committee was considering other than lighting undertakings, but it was not confined to traction; and in any case, whether traction or other power, or lighting, the question before the Committee was the extent of possible injurious affection to other systems, and this is the real point.

I have dealt here with some of the technical aspects of Mr. Bartholomew's article, but must leave others to be dealt with by those better qualified than myself. In conclusion, I would like to lay stress on the absolute necessity of reducing, so far as can be done safely, the cost of electricity, both for power and lighting purposes, if we are to maintain our position in the manufacture and supply of goods, in the face of the competition we are up against with other countries straining every nerve, and adopting the very latest technical practices. Every manufactory is dependent on getting its electric lighting and power as cheaply as possible, and the future of the country must stand or fall according to adoption of improved methods, such as we see elsewhere. It goes also to the very heart of the question of unemployment, which the Government is bound and pledged to grapple with.

GOVERNMENT ASSISTANCE FOR COMPANY SCHEMES.

The following announcement, issued by the Unemployment Grants Committee under date October 10th, relates to assistance to companies undertaking works of public utility. We refer to the subject in our leader pages:—

"As announced in Parliament, the Government have formulated proposals designed to provide employment in depressed industries by stimulating the acceleration of work by companies operating undertakings of a public utility character.

"It has accordingly been decided to extend to such companies as are prepared to commence during the coming winter works that would not otherwise be undertaken at the present time, financial assistance in respect of revenue-producing works similar to those undertaken by local authorities. Such works would include gas, water, electricity, tramways, docks, harbours and canals.

"All applications should be addressed to the Secretary, Unemployment Grants Committee, 23, Buckingham Gate, S.W.1.

"The terms on which Government assistance will be granted to approved works are as follows:—

"(1) Works which would not be proceeded with at the present time, apart from the pressing need for relieving unemployment are alone eligible.

"(2) The works in respect of which assistance is desired must be of a public utility character, *e.g.*, gas, water and electricity, tramways, docks, harbours and canals.

"(3) The works must be of such a nature as will afford employment during the coming winter in industries at present affected by severe unemployment.

"(4) The Committee will require to satisfy themselves as to the reasonableness of the tender accepted for the works. It will be a condition of all contracts that the material employed shall be of British manufacture.

"(5) Assistance will be limited to a maximum of 50 per cent. of the interest on the expenditure as and when incurred, out of capital raised, and will normally be given only for the period during which the expenditure is not reasonably remunerative.

"(6) The undertaking will normally be required to submit to such limitations as to the distribution of profits, &c., during the period of assistance as may be necessary to secure in the opinion of the Committee that no undue advantage is taken of such assistance. Each case will, in this respect, be considered separately upon its merits.

"(7) The approval of the Committee will be required for the terms on which the capital is raised.

"(8) The Committee will require to be satisfied in such manner as may be mutually arranged without interfering with the company's responsibility for the execution of the works that the work will be or is being satisfactorily carried out and in accordance with the foregoing conditions."

AUSTRIA'S NEW INDUSTRIAL PROBLEMS.

The changed aspect of the manufacturing industries of the new Austria is reviewed in the report* of H.M. Commercial Secretary at Vienna (Mr. O. S. Phillpotts, O.B.E.). Outside the narrow limits of the new State the Austrians have now to compete on equal terms with the whole world in selling their goods, but their factories were never intended for such competition when they were started, and many of them are heavily handicapped. The great distance from fuel supplies affects some of them much more than it used to do. They no longer enjoy the system of subventions which the former Austrian railway system extended to them. Thus coal, coke, wood, and many other raw and semi-manufactured materials were formerly carried at almost a loss for the benefit of the factories, while the finished goods were carried very cheaply to Trieste. The metal and machinery trades have passed through a period of severe depression. Mr. Phillpotts points out that wages paid in Austria, although far below those paid in the western countries of Europe, not to mention the United States, have frequently been considerably above those paid in Germany. Employers complain bitterly of the effects of the eight-hours' day, of the slackness of labour, and of the high cost of social insurance. He remarks appositely that these complaints are heard in most countries. To summarise, it is apparent that Austrian industries will have to go through a far-reaching process of re-organisation in order to meet the new conditions.

The machine industry, which is one of the most important in Austria, exported less last year than in 1921, owing, not only to German competition, but also to import prohibitions in various neighbouring countries. The trade in electric lamps, says the report, did well.

Water Power. Some progress has been made with the exploitation of the Austrian water power, which it is hoped will some day enable the coal imports to be much reduced. Ten large works, yielding together 22,600 h.p., were completed by the end of 1922; 30 other large works, with a total of 211,000 h.p., are being proceeded with. Of these, nine, of a total of 34,000 h.p., were begun during 1922; 900 small stations of less than 500 h.p. each are also being built or planned. Lack of capital is delaying the progress of most of the larger works, which are being carried out under the patronage of the provincial Governments.

The electrification of the State railways in the west of Austria is also delayed for the same reason, but it is hoped that electrical operation will be commenced on the first stretch from Innsbruck to Landeck before the end of 1923. The first of the new locomotives required have already been completed by local firms.

The attempts made to induce foreign capital to invest in the development of the Austrian water power have so far not been successful, though some projects are being investigated by British and other firms. About one-tenth of the practically usable water power has so far been actually harnessed, a much lower proportion than, for instance, in Switzerland.

The next question is what effect the stabilisation of the Austrian crown has had on the country's export trade. While the currency was falling rapidly there was a boom in exports. The Commercial Secretary says that these were made frequently at a loss, generally without its being fully realised, because the books showed a paper crown profit. In his opinion the stimulus to exports furnished by the fall in the crown was deceptive, and its stabilisation first allowed the real position of the Austrian industries to be fully realised.

Vienna's importance in international trade and finance, which Mr. Phillpotts forsees will revive, is due to the fact that the capital lies at the meeting point of two great trade routes. This geographical advantage remains, and it is considered that no other city can take Vienna's place as the economic centre of this much-divided part of Europe, as the technical apparatus of trade and the experience and connections of its merchants and bankers are not to be found elsewhere. The entrepot trade is important. Vienna serves the whole of the Succession States and the Balkans, and, in some degree, also the Near East.

*Department of Overseas Trade, 2s.

ELECTRICAL CONSTRUCTION IN LATIN AMERICA.

(From Our Own Correspondent.)

A Colombian company has been formed in the Department of Tolíma for the purpose of introducing electrical power into the district. It is proposed to employ the water-power of the Coëllo River, and furnish current to a number of municipalities, and to irrigation pumps.

The important Peruvian company, the Empresas Electricas Associádos, of the City of Lima, is about to install a new street car line to the end of the Santa Beatriz city boundaries, and to entirely reconstruct all the city street-car lines in conformity with a notice served upon it to this effect by the responsible authorities. The object of the reconstruction is mainly to avoid causing damage to the water-pipes of the city by electrolysis; but, apart from this fact, the physical depreciation of the lines has long called for attention.

A new electrical plant is to be installed to furnish the Venezuelan town of Timotis with current for both industrial and lighting purposes. Several mines in the district will take the current and convert their present machinery to electrical driving.

Progress is being made with an installation of electric lighting plant in Santa Cruz, Bolivia, for the purpose of supplying light and power to that town. The contract was secured by a firm of United States engineers, which recently landed the full equipment of machinery and plant.

In Colombia the Energia Electrica Municipal, of Manizales, Department of Caldas, has added considerably to its installation of electric light plant by the acquisition of new dynamos. The capacity of the plant has been increased 50 per cent.

It is intended to exploit the large and hitherto little-used water-power possibilities of Costa Rica, and for this purpose an influential syndicate has been formed with the necessary capital. The four existing stations, all of about the same size, and located at San José, San Ramón, Miramár and Abangarez, are found to be insufficient for the demand for current, which can be supplied in Costa Rica at the exceptionally low rate of 1 colón (nominally 1s. 11d.) per light per month, regardless of use. A new electrical plant has recently been introduced at Barro Morado, Cartago.

The electrification of the Buenos Aires Western suburban service has now been completed, and put into operation between the Buenos Aires terminus (Once Station) and Moreno, a distance of 36 km. Power is supplied from the company's own plant located at the south dock. A 20,000-volt, three-phase current is stepped down to 800 volts by means of rotary converters. At the Once Station and at Villa Luro there are three converters, and at Castellar and at Moreno terminus two each. An under-running contact with an insulated rail of 86 lb. per yard conveys the power to the coaches, of which there are at present 47, with the customary built-in "all-electric" control carrying 200 h.p., running at 600 r.p.m. There are, additionally, 45 tractor coaches, while for the goods service between Once and the port of Buenos Aires electric locomotives are used, taking their power from an aerial wire. The construction of this railway has already brought, beyond valuable transport facilities, an increase in land values. The suburbs served by this 36 km. track are already becoming extremely popular from a residential point of view, and general praise is given to the Buenos Aires Western Railway Co. for its enterprise.

Work upon the electrification of the Chilean State railways has made sufficient progress to enable a trial run to be made over part of the track, namely, that between the capital (Santiago) and Tiltil. It is understood that the test proved in every way satisfactory. It is estimated that the upkeep under the new system will reduce Government expenditure on the State railways by as much as $10,000,000 per annum. Should this prove to be the case a substantial reduction in transport charges will be called for.

"Safety" Anti-dazzle Headlamps.—A new type of automobile head lamp was recently demonstrated by Capt. A. S. Ward, the inventor, under the auspices of the Institution of Patentees (Inc.). The R.A.C. has already granted a "non-dazzle" certificate in respect of the lamps, from which the following is an extract: "The lamps dazzled an observer (eye level 4½ ft.) advancing towards them down the centre beam, *at no point*. On approaching the lamps (with an eye level of 4½ ft.) there was no blinding effect." The new type of lamp is also said to comply fully with the Ministry of Transport's proposed regulations for anti-dazzle head lamps, the conditions being: (1) There should be a main beam of light having (*a*) a minimum range of forward illumination of 150 and a maximum of 300 ft.; (*b*) a minimum width of 30 ft. with a maximum height of 4 ft. from the ground at 150 ft.; (*c*) the beam to strike the ground at not more than 50 ft. from the lamp; and (*d*) the field to be uniformly illuminated. (2) In addition to the main beam there must be a field of diffused light not exceeding 50 ft. or less than 25 ft.; the beam not to exceed 4 ft. from the ground. The lamp, all the light from which is reflected, has two bulbs; the larger is placed in the crown and the smaller in the well of the lamp at angles of approximately 10 deg. to the horizontal and vertical respectively; each bulb has a metal reflector and a third, which is provided with wings, is placed at the back of the lamp. Each bulb has a separate switch so that they can both be used at once, or the larger one for country, and the smaller one for town driving. The new lamp certainly reduces the dazzle effect considerably; it throws powerful illumination directly in front of the car, and provides ample side illumination, but it would seem that some of the latter could with advantage be sacrificed in favour of more driving light.

MANCHESTER CORPORATION ELECTRICITY DEPARTMENT.

On Thursday, last week, the new Barton power station of the Corporation of Manchester was formally opened by the Earl of Derby, K.G., in the presence of the Lord Mayor (Councillor W. Cundiff), the Chief Electricity Commissioner (Sir John Snell), and a large assembly of members of the Corporation of Manchester and neighbouring local authorities, well-known engineers, directors of manufacturing firms, and other professional and public men. Prior to the ceremony, the visitors were conducted over the generating station in small parties. On the arrival of Lord Derby, with the Lord Mayor and Lady Mayoress, Sir John Snell, and the Town Clerk, he was received by Ald. W. T. Dagnall, chairman of the Electricity Committee, and after the leading men had been introduced to him, started the second turbine; briefly expressing his appreciation of the honour done to him, he congratulated the city, the engineer, and the workmen on the great work that they had accomplished. He was then presented with a copy of the extremely handsome and artistic brochure that had been prepared for the occasion.

Afterwards the guests, numbering over 400, were entertained at luncheon in the Town Hall by the Corporation. After the Lord Mayor (Councillor W. Cundiff) had given the loyal toasts, Ald. W. Walker proposed the health of Lord Derby, and Sir Philip Nash, K.C.M.G., C.B., chairman of the Metropolitan-Vickers Electrical Co., Ltd., on behalf of the principal contractors, presented Lord Derby with a handsome silver casket, designed and made at the Manchester School of Art and containing an illuminated address. Lord Derby expressed his keen appreciation of the gift. Declaring that it was rightly due to Mr. Pearce, who had borne the chief responsibility, he entrusted the casket to the care of Mr. Pearce for his lifetime, after which it would be restored to the Stanley family. He drew from the working of the turbines the moral that they should all give of their very best in the service of the community.

After Lord Colwyn had proposed the health of the Lord Mayor and the latter had responded, Sir John Snell, Chief Electricity Commissioner, proposing "The Manchester Electricity Undertaking," showed how the development of steam power had helped to restore the fortunes of the country after the Napoleonic wars, and expressed the belief that similarly electricity would play a great part in its recovery from the effects of the greatest war in history. A hundred years ago this was the only industrial country; now other countries were well equipped, and their competition could be met only by the increased use of electricity. Moreover, waste of coal would be reduced by collective generation. He commended the impartiality and sound judgment of Mr. Pearce, whose work had resulted in an annual consumption of 200 kWh per head of a population of 850,000, at the average price of 1¾d. Credit was also due to the staff, the civil engineers, and to the Electricity Committee.

Ald. W. T. Dagnall, responding, quoted a letter from Sir Charles W. Macara, whose Ancoats mill was the first to be electrically driven, and who stated that during 15 years there had only been two hours' stoppage through failure of the supply. There were now 33 cotton mills connected to the mains, taking 25¼ million kWh per annum. The policy of the Corporation was to cheapen the cost of power rather than to reduce the price for lighting. The new power station embodied the most up-to-date features, and best of all, it was British made. They were proud of Mr. Pearce, to whom the success of the undertaking was due.

Councillor L. F. Massey, deputy chairman of the Barton Works Sub-Committee, proposed "Our Guests," pointing out that the local authorities and companies were now all united in the big co-operative scheme of South-East Lancashire. Sir Ed. Stockton, M.P., responded to the toast.

Mr. S. L. Pearce then proposed "The Contractors," thanking Lord Derby for entrusting the casket to his care, and the contractors for providing it. He expressed his high appreciation of the loyal and able services of his staff, especially the deputy chief engineer, Mr. H. C. Lamb, and of the consulting engineer, Mr. H. N. Allott. Twelve hundred drawings had been issued to more than 50 contractors, who had done their work well, and cordially co-operated with the staff and with each other. He was already able to state that the thermal efficiency of the plant far surpassed the best figures published by the Electricity Commissioners in their recent report.

Mr. G. G. Lynde and Sir Philip Nash responded, the latter remarking that of 11 large municipalities, with an average consumption of 135 kWh per head per annum, Manchester came first with over 200; but there was still enormous scope for further development in this country, whose manufactures were not inferior to any in the world in any branch of engineering.

The undertaking in March last had 27,511 consumers, representing connections equivalent to 315,861 kW; generating plant rated at 126,750 kW, with a maximum demand of 94,800 kW; an output of 244 million kWh per annum, and a coal consumption of 222,367 tons. The capital expenditure amounted to £7,211,066, and the annual revenue to £1,394,625. The new power station was constructed to the designs and under the supervision of Mr. S. L. Pearce, C.B.E., M.Sc(Tech.), and his staff; Messrs. C. S. Allott & Son, consulting engineers, were responsible for the general civil engineering work.

The generators, working at 6,600 volts, are connected directly to the corresponding transformers, the whole of the switching being done on the secondary side at 33,000 V. Four 0.3 sq. in. feeders connect the power station with the Manchester area, and four of 0.2 sq. in. cross section give bulk supplies to the Lancashire Electric Power Co. and the Stretford Urban District Council respectively. Five distributing stations have been built in the Manchester area, one of these being the first outdoor 33,000-V sub-station in this country.

THE CYCLE AND MOTOR-CYCLE SHOW.

There are few exhibitions more intimate in their appeal to the masses than the display of cycles and motor-cycles, which opened at Olympia on Monday last and will close to-morrow, that is promoted annually by the British Cycle and Motor-Cycle Manufacturers' and Traders' Union. It is a comprehensive exhibition of two- and three-wheeled machines, both engine and pedal propelled, but it is again noticeable this year that the number of electrical accessories on view seems to be smaller than ever. True it is that on the 286 stands several machines are to be seen which are provided with electric head and rear lamps, but amongst the main exhibits the only machine of electrical interest is the product of the Argson Engineering Co., Ltd., which shows, amongst other invalid carriages, an electrically-propelled three-wheeled bath chair. It has already been described in our pages.

Magnetos are to be found on some seven stands, the products of such firms as E.I.C. Magnetos, Ltd., Fellows Magneto Co., Ltd., Messrs. North & Sons, Ltd., M.-L. Magnetos Syndicate, Ltd. (also "Maglitas" combined lighting and ignition sets), the British Thomson-Houston Co., Ltd. (which also shows simple generator lighting sets; combined lighting and ignition magneto generators; a flywheel magneto fitted with a device for collecting current during the "idle half-wave" for charging a battery for lighting; and impulse starters), Messrs. C. A. Vandervell & Co., Ltd. (who also exhibit dynamo lighting equipment; "Dynamag" sets; and batteries, lamps, switch holders, &c., and a combination dynamo and coil ignition set), Lucas Electrical Co., Ltd. (also impulse starters; combined lighting and ignition sets; batteries, switches, lamps, horns, &c.).

Sparking plugs are, of course, essential components of motor-cycle engines, and are displayed on about ten stands, including such types as Fellows, C.A.V., Sphinx, K.L.G., Lodge, and Vita. While on this subject it is of interest to note that the judges' report on the recent six days' trial run, which was issued by the Auto Cycle Union on the eve of the show, is said to contain a statement to the effect that sparking plugs proved to be one of the least satisfactory components of the machines taking part.

Electric lighting outfits, lamps and accessories are exhibited by a number of firms, amongst which, besides those already named, mention may be made of Messrs. Dunhills, Ltd., J. A. Ryley, Brown Bros., Ltd., Astra Dynamo Co., Etienne & Cie., Dekla, Ltd., Clayton-Wright, Ltd., Powell & Hammer, Ltd., and the Manufacturers' Accessories Co., Ltd., both battery and dynamo lighting outfits for pedal bicycles being noted on two or three of the stands as well.

The exhibit of Messrs. Batteries, Ltd., consists of a selection of "Nife" accumulators, hand lanterns, miners' lamps, &c.

Messrs. W. Canning & Co., Ltd., show plating and polishing equipment, low-voltage dynamos, a motor generator, electric polishing and grinding machines, &c.

The Villiers Engineering Co., Ltd., has an interesting display of lighting sets and also several examples of its flywheel magneto, which, as its name implies, is incorporated in the flywheel of the engine.

Never-Stop Railway. — According to the *Westminster Gazette*, a contract has been concluded for the erection of a "Never-Stop" railway at the British Empire Exhibition. The cost will be in the neighbourhood of £100,000. A double track will be laid connecting up most of the main parts of the Exhibition with the Metropolitan and the Great Central stations. It will be capable of carrying 20,000 passengers per hour in each direction. It was considered to be the only system capable of dealing with the enormous traffic expected, and will be practically noiseless, as the cars will run on rubber wheels. For a third of its distance it will be on the ground level, and for the remaining two-thirds elevated.

The High-Pressure Congress.—The president of the Union des Syndicats de l'Electricité, reporting at a meeting held in Paris last week, stated that twelve countries, including Great Britain, had notified their intention of participating in the international conference concerning very-high-pressure lines, which is to be held between November 26th and December 1st at 7, Rue de Madrid, Paris, as in 1921.

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CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Price Reductions?

As a consumer of the County of London Co., and also the Charing Cross Co., I should like to add my protest against the exorbitant charges of the supply companies with which I am connected, and I should like to ask the Electricity Commissioners why I should be forced to take my supply from a monopolist whose maximum (and present) charge is fixed at a figure 50 per cent. greater than it should be.

If the Wimbledon Corporation were allowed to supply me with current I should save about £12 per year at present prices at my Southfields branch alone. Surely if we cannot have competition, &c., we are entitled to proper control, and if the figures quoted in Mr. Wallis's letter are correct, it seems time these maximum charges were revised.

Surely this is a question that should be taken up strongly by the electrical Press, for, as Mr. Hugo Hirst told us through the ether, cheaper electricity is necessary for the development of everything electrical.

Mr. Hirst, if I remember correctly, alluded to "cheaper production" of electricity; this is, of course, all right so long as the consumers, and not the proprietors of the supply companies, get the benefit of the cheaper production.

Cheaper retailing is what we want, but the public (?) electricity supply companies appear to have a different motto from the municipal authorities, which aim to supply at a fair figure with fair profits; the companies generally appear to treat the matter in the business way of monopolists, and just charge all they can.

Reverting to the electrical development, how many people on the County of London system are there who can afford to run an electric cooker at 2½d. per unit? Has the County of London Co. nothing to say about this business?

F. Morton Wybrow.

Southfields, *October 16th*, 1923.

The Prospects of British University Engineering Graduates in the United States.

In view of the facts that the apprenticeship system of training engineers is not in common use in the United States of America, and that a large number of our university-trained engineers, myself among them, are still without posts, and likely to be so for a time to come, it would be particularly interesting to know what are the immediate prospects of employment for university graduates in engineering in the United States?

Perhaps a reader can furnish some information on the above. I, and many others, will be much obliged to him.

I would add that a number of engineering graduates have taken, and are taking, advantage of the Colonial Settlement Scheme to take up farming in the Colonies. It is a great pity that talented young engineers should be lost to the profession, even through this very admirable channel. Their talent would be of greater use to Britain as capable engineers in the U.S.A. than as rule-of-thumb agriculturists in Australia and elsewhere.

J. R. Evans.

Bangor, *October 15th*, 1923.

Quick-Make-and-Break Switches.

May I, as a practical electrician, and with 15 years' experience as inspecting engineer to a public supply authority, call attention to the failing of many contractors in connection with the above type of switch?

The use of quick-make-and-break switches in private houses is generally not at all necessary, and for obvious reasons should not be adopted.

During the last twelve months or so the number of complaints from householders on the score of noise in "switches going off with a whack no matter how slowly they are operated," has been rapidly increasing. In one case I know of, the lady of the house sent for the contractor and gave him a bad quarter of an hour over this matter; and in another instance the master of the house frequently working late hours, is at present in the habit of striking matches when he comes in in order to avoid operating these noisy switches. These two cases (among a great many) are quite *bona-fide*.

The ordinary householder does not care two hoots whether the small lighting switches will break 4, 5, or 6 amperes at 250 volts, and after all, why should he, when these circumstances are, in private houses, beyond practical politics and never arise?

It is such small matters as these, the want of thought on the part of some contractors and their inability to place themselves in the position of the non-technical consumer, that often cause endless trouble.

Nowadays, it is up to all to do our utmost to popularise electricity, and to assist the praiseworthy object of electrical development, especially in these times when the gas undertakings are making such strenuous efforts.

I should be glad to hear of other readers' experiences with noisy switches.

Silence.

October 11th, 1923.

LEGAL.

Oliver v. Frielinghaus.

In the Mayor's and City of London Court, on October 9th, before Judge Shewell Cooper, Mr. Edward G. Oliver, solicitor, 3 and 4, Gt. Winchester Street, sued Mr. Arthur Frielinghaus, merchant, 123, Wool Exchange, for one quarter's rent of 101, Eaton Place, let furnished under an agreement of January 26th. Defendant paid the claim but raised a counter-claim for the same amount and complained that the electric light installation was so defective that within a fortnight of his entering into occupation it failed in a substantial part of the house and he had been put to the expense of the amount now sued to put it right. In support of the counter-claim it was stated that defendant went into possession on February 15th, and on March 5th eleven lights in the lavatories and some in the dining-room and library proved defective. There was a short-circuit and that involved the danger of fire. Defendant had to have the defects put right at a cost of the sum counter-claimed.

Judge Shewell Cooper, after hearing electrical evidence, said he was not satisfied that there were defects as alleged by the defendant. He would not be justified in extending the law by holding that the failure of eleven electric lights, which could easily have been repaired, constituted such a defect that the house was unfit for reasonable occupation. It was only a temporary inconvenience. Judgment would be given for the plaintiff on the claim, and the counter-claim would be dismissed, both with costs to the plaintiff.

British Thomson-Houston Co., Ltd. v. Rennell and Others.

Mr. Justice Romer, in the Chancery Division, on October 12th, granted injunctions—on the motion of the plaintiffs—restraining B. W. T. Rennell from infringing their patents in relation to leading-in wires for incandescent electric lamps; and Saul Fish and Kesler & Co., from infringing their letters-patent for the "half-watt" lamp.

In the last two cases injunctions were also granted restraining the defendants from parting with the infringing articles.

Wireless Installations, Ltd.

In the Winding-up Court, on October 16th, Mr. Justice Romer made an order for the compulsory liquidation of this company, upon the petition of Rotax Motor Accessories, Ltd., Willesden Junction, judgment creditors for £88, and costs.

Counsel for the company said he could not oppose the petition so far as the company was concerned, but he wanted an adjournment on behalf of the debenture holders, as negotiations were pending with a view to the company's being reconstructed.

Mitchell's Electrical and Wireless, Ltd.

Mr. Justice Romer in the Winding-up Court, on October 16th, made an order for the compulsory liquidation of this company, upon the petition of J. Stone & Co., Ltd., judgment creditors for £91.

American Diesel-electric Ships.—Two Diesel-electric ships are being built at the Great Lakes Engineering Works, Ashtabula, U.S.A., to the order of the McDougal Terminal Warehouse Co. The length of each of these vessels is 250 ft., the beam being 42 ft., and they are intended for the conveyance of refrigerated and ordinary cargo. One of the ships has been named *Twin Cities*, and the other *Twin Ports*, and the deadweight capacity of each vessel is about 2,100 tons. Two six-cylinder engines, each of 350 b.h.p., are installed, driving a dynamo which supplies an electric motor coupled to the propeller. The engines are of a new type developed by the Lombard Governor Co., Salem, Mass., and have cylinders 13 in. bore and 19½ in. stroke. The *Twin Cities* is due for delivery during the course of this month.—*Motor Ship*.

Manchester Electro-Harmonic Society.—The Society opens its season on October 26th at the Albion Hotel, Picadilly, Manchester, with a concert to be contributed to by a number of well-known artistes. Mr. S. L. Pearce, C.B.E., chief electrical engineer of the city, will preside. Five other concerts will be held during the season. The Society now has a membership of about 250.

THE NORTH WALES AND SOUTH CHESHIRE JOINT ELECTRICITY AUTHORITY.

First Meeting.

The first general meeting of the North Wales & South Cheshire Joint Electricity Authority was held at Llandudno, on October 12th. Representatives were present of all the County Councils embraced in the area, *viz.*, Cheshire, Flintshire, Derbyshire, Carnarvonshire, Montgomeryshire, Shropshire, Anglesey, and Merionethshire, also of the Crewe and Wrexham Corporations and the Llandudno and Colwyn Bay Urban District Councils, users of electricity in bulk. The railway companies were jointly represented by Lieut.-Col. F. A. Cortez Leigh, of the London, Midland & Scottish Railway, and the North Wales Power Co. by Messrs. H. J. Jack, managing director, Evan R. Davies, Crossley Colley, G. K. Paton and C. W. Crewe. Sir Harry Haward, vice-chairman of the Electricity Commission, and other Commissioners were present, and Sir Harry, who presided, addressing the meeting, said the occasion was unique inasmuch as that was the first Joint Authority established under the provisions of the Electricity (Supply) Acts.

Area of Supply.

The area was approximately 4,065 sq. miles, and comprised six whole counties, and parts of three other counties. It had within its boundaries sixteen boroughs, 36 urban and 40 rural districts. The population in 1921 was 740,377, and the rateable value approximately £4,384,000; there were 33 undertakers authorised to supply electricity, of whom 18 were, in fact, supplying electricity. The total amount of electricity actually sold by all authorised undertakers within the district in 1922 was 14¼ million kWh, equal to 19¼ kWh per head of the population. Of the total the Power Co. sold eight and a half million kWh. It was estimated that the demand in the district would reach a total of from 40 to 45 million kWh in 1925, and from 80 to 90 millions in 1930. The company would be subject to a more stringent sliding scale of prices and dividends, and it would be in the interests of the company's shareholders for the company to reduce the average price as far below 1½d. per kWh as possible, as the lower average price the higher the dividends it might pay. The sliding scale would begin as soon as the company was able to pay more than 10 per cent.

Having detailed the duties of the Authority, Sir Harry said that the Commissioners felt that the success of the new organisation would largely depend on the spirit in which the Joint Authority and its transferee (the North Wales Power Co.) worked the arrangements which had been decided upon.

Finance.

Sir Harry then dealt with the financial position of the Power Co. The first stage of the new work was estimated to cost about £1,400,000, and the Power Co. had applied to the Treasury to guarantee the principal and interest of a loan not to exceed £1,500,000, and the Treasury was going to guarantee a loan which would cover the total cost of the new work, including interest during construction. The company would thus obtain the necessary capital upon the most favourable terms.

During the past year the company had extended the 35,000-volt transmission line from Colwyn Bay, *via*. Conway to Penmaenmawr, and connected the Penmaenmawr line direct to Dolgarrog; it had built the 65,000-volt line from Colwyn Bay *via* Llandudno to Conway, a 35,000-volt line had been built from Bethesda to Bangor, and a 35,000-volt line from Conway to Rhuddlan was nearly complete. Surveys had been completed for many other lines, and negotiations for wayleaves for those lines were being actively conducted. Supplies were being given to Llandudno, Colwyn Bay, Conway and Bangor, and agreements had been completed with Carnarvon, Rhyl, Connah's Quay and Hawarden. The company had practically settled the terms of an agreement with the London, Midland & Scottish Railway Co. for supplying the latter's works at Crewe, and the terms with the Mersey Power Co. had been provisionally settled.

Mr. Arthur Hewitt, chairman of the Llandudno Urban District Council, was unanimously elected chairman of the Joint Authority until April 1st, 1926, and Lieut.-Col. F. A. Cortez Leigh was appointed vice-chairman for the same period. Mr. A. Connolly, clerk to the Llandudno District Council, at the invitation of the Authority, agreed to act as clerk, *pro tem.* A resolution was adopted by which the Joint Authority approved of the transference to the Power Co. of the powers, rights, and obligations specified in the Commissioners' Order of 1920, subject to the Commissioners being satisfied that the Treasury would guarantee the loan to the Power Co.

BUSINESS NOTES.

Bankruptcy Proceedings.—F. J. Mason (Sunnyvale Engineering Co. and Magandynamo Co.), automobile electrical engineer, Asquith Street, and 24, Rider Road, Woodhouse, Leeds.—Receiving order made October 9th on debtor's own petition.

E. W. J. Whitelock, electrical engineer, 4, Leagrave Road, and 7, Cheapside, Luton.—First meeting October 20th at the Official Receiver's office, The Parade, Northampton. Public examination November 22nd at the Court House, Luton.

C. W. Stocken and C. Fink (Windham Radio Supplies), 80, Redcliffe Street, Bristol.—Trustee, Mr. J. P. Emett, 18, Nicholas Street, Bristol, appointed October 9th.

W. H. Micklethwait, electrician, 2, Coronation Grove, Oatlands, Harrogate.—Last day for proofs for dividend October 27th. Trustee, Mr. D. S. Mackay, Red House, Duncombe Place, York.

W. E. Weeks, electrical dealer, 59, Victoria Street, and 12, Filton Avenue, Horfield, Bristol.—First and final dividend of 4s. 5d. in the pound payable at the trustee's office, 18, Nicholas Street, Bristol.

F. Silver, electrical and mechanical engineer, 40, Dublin Street, Edinburgh.—Public examination October 23rd at the Sheriff Court House, Edinburgh. Meeting of creditors November 20th at 9, York Place, Edinburgh.

F. B. Thorpe, electrical engineer, 1a, West Laithe Gate, Doncaster.—Receiving order made October 12th, on debtor's own petition.

Company Liquidations.—"Z" Electric Lamp Manufacturing Co., Ltd.—A meeting of members is called for November 14th at Orient House, New Broad Street, E.C., to hear an account of the winding-up from the liquidator, Mr. B. H. Binder.

Electric Prepayment Meters, Ltd.—A meeting of members is called for November 22nd, at 62 & 63, Queen Street, E.C., to hear an account of the winding-up from the liquidators, Messrs R. Bernheim and F. E. Stanley.

Dissolutions of Partnership.—Campion Factoring Co., dealers in cycle and motor-car accessories, electrical goods, &c., 37, Pelham Street, Nottingham.—Messrs. E. F. Hutchinson and E. W. Campion have dissolved partnership. Mr. Hutchinson will attend to debts and continue the business under the style of "The Factoring Co." at the same address.

Dickson & Co., electrical, mechanical and automobile engineers, 522, Manchester Road, Hollinwood, Manchester.—Mr. J. Dickson and Mr. J. M. Norwell have dissolved partnership. Mr. Norwell will attend to debts and continue the business under the style of Norwell, Dickson & Co. at the same address.

Electric Light, Motor & Engineering Co., 7, Victoria Square, Truro.—Mr. T. Manson, Mr. J. F. Kendal and Mr. G. A. Edwards have dissolved partnership. Mr. Edwards will attend to debts and continue the business.

Trade Announcements.—The Stockport Lamp Co., Ltd., electric lamp makers, of Archer Street, Buxton Road, Great Moor, Stockport, announces that it is giving up business.

Messrs. A. H. Hunt, Ltd., have appointed Mr. H. H. Patrick, 131, Coventry Road, Birmingham, as their agent for the Midlands.

Mr. Fred. J. Webb, who has commenced business as an electrical engineer and contractor at Barrack Square, Chelmsford, desires to receive catalogues.

Mr. G. Stanley Brown has re-commenced business as an electrical engineer at 3, Mincing Lane, London, E.C.3. He had to relinquish his connection when at Caxton House early in 1915 owing to the war. He asks for catalogues.

Catalogues and Lists.—Messrs. A. H. Hunt, Ltd., Tunstall Road, Croydon.—Two illustrated and priced pamphlets dealing with "Hellesen" dry batteries for radio work, including batteries for dull-emitter valves, valve-holders, variable grid leaks, &c.

Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2.—Pamphlet No. 218, describing in some detail the "Popular" radio-telephony transmitting and receiving equipment. Fully illustrated.

The Waltham Manufacturing Co, 2, Jackson Road, Holloway, N.—A price list of accumulator-charging resistances.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Conduit Price Schedule, No. 995.

Messrs. Simpson, Baker & Co., 2-5, Nelson Street, Bristol.—A comprehensive illustrated price list of lighting fittings, including brackets, bowls, pendants, shades, lanterns, &c.

Walker Vehicles, Ltd., Caxton House, Westminster, S.W.1.—A series of illustrated pamphlets describing the construction and working of "Walker" electric vehicles and "Railodok" industrial trucks.

Electric Fires, Ltd., King Street, Norwich.—An illustrated booklet describing "Heatrae" fires in a non-technical manner. Priced.

Matériel Électrique Alex Lefebvre, 9, Rue Arsène Houssaye, Paris, VIIIe.—List of power plant, motors, boilers, transformers, &c., for sale.

Messrs. Bostock & Bramley, Netherton, Huddersfield.—An illustrated pamphlet describing concentric speed-changing gear.

Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, W.C.1.—Two illustrated and priced pamphlets dealing respectively with a patent "eliminator" for broadcasting wave-lengths, and radio-frequency transformers and reactances.

Drake & Gorham Wholesale, Ltd., 67, Long Acre, W.C.2.—An illustrated and priced list of electric fires, cookers, kettles, irons, toasters, and other appliances of various makes.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Leaflets Nos. 39/1-1, describing squirrel-cage induction motors; 59/4-1 and 59/5-1, dealing with auto-transformer and star-delta starters; and Circular No. 1,059/1, containing exhaustive details of 650-V automatic oil-break, iron-clad switchgear, motor starters, controllers, &c. All these publications are profusely illustrated.

Messrs. Bastian & Allen, 58, Haymarket, S.W.1.—An illustrated catalogue giving particulars and prices of electric fires of many patterns. Also a folder dealing with "Bastian" electric geysers.

Messrs. Newton & Wright, Ltd., 471-3, Hornsey Road, N.19.—Two illustrated folders describing the "Harley" dental X-ray apparatus and other X-ray equipment. Priced.

The Hydraulic Engineering Co., Ltd., Chester.—An illustrated brochure describing the "Mangnall-Irving" thrust-borer and methods of working.

Messrs. Philips & Turner, 115, Edmund Street, Birmingham.—A series of leaflets illustrating lighting fittings, including "galleries," ceiling plates, brackets, chains, bowl rings, &c.

Book Notices.—Sir Isaac Pitman & Sons, Ltd., have issued an Autumn list of their latest books. These deal with a multitude of subjects—academic, technical and commercial. Many new and re-published electrical works are included in the list.

"Burn's Income Tax Guide." Fifth Edition, covering 1923 Budget. Edinburgh: W. Green & Son, Ltd. Price 2s. 6d. net.

"Post Office Electrical Engineers' *Journal*." Vol XVI; Part 3; October, 1923. London: Electrical Review, Ltd. Price 2s. net.

"Elementary Electricity," by S. G. Starling. Pp. viii+248; 216 figs. London: Longmans, Green & Co. Price 3s. 6d.

Directory and Chronicle for China, Japan, Straits Settlements, Indo-China, Phillipines, 1923. Hong Kong: Hong Kong Daily Press. London: 131, Fleet Street, E.C.4. Price 40s. net. Postage 1s. 3d.—This is a very useful work of more than 1,700 pages full of information which should be of particular value to British manufacturers and traders desirous of establishing business relations with the Far Eastern territories named in its title, or to those who are contemplating taking up positions there and want to know many things before they go. A large amount of space is devoted to reprints of the treaties of Great Britain with China, the revised import tariff, and many agreements between us; also treaties between China and France, the United States, Japan, and so on. The Customs Tariff of Japan follows in detail, as well as particulars of treaties between Japan and Russia and certain other countries. Orders in Council governing British subjects in China and Corea are reprinted; the constitution and rules of the Executive and Legislative Councils of Hong Kong; Hong Kong port regulations; Japan harbour regulations; stamp duties; consular fees; weights, measures and money, and other matters. The rest of the volume—nearly 1,300 pages of it—consists of directory information for all centres of consequence—names classified as to trades, and finally a valuable list of foreign residents in 1923 in China, Japan, Corea, Vladivostock, Hong Kong, the Philippines, Siam, Straits Settlements, and many other parts.

Messrs. F. W. Berk & Co., Ltd., have published, through Dod's Publications, Ltd., a brochure dealing with the chief British and Dominion ports and industrial centres. The work is very well illustrated and concludes with a note upon the firm's activities as chemical manufacturers and merchants.

"Engineering Abstracts," No. 17; October, 1923. London: Institution of Civil Engineers.

"Electrical Engineering Practice," by J. W. Meares and R. E. Neale; Fourth Edition, re-written and enlarged; Vol. I. Pp. x+584; illustrated. London: Chapman & Hall, Ltd. Price 25s. net.

Extensions at Bloemfontein.—The Senior Trade Commissioner in South Africa (Mr. W. G. Wickham) has forwarded a report on the proposed power-house extensions of the Electricity Supply Department of the Bloemfontein Municipality prepared by the Council's electrical engineers, Messrs. G. M. Clark & Partner, 40-42, Meischke's Buildings, Johannesburg. A copy can be inspected by British firms interested at the Department of Overseas Trade (Room 52), 35, Old Queen Street, London, S.W.1.

Railway Charges.—The Mansion House Association on Railway and Canal Traffic for the United Kingdom, on the 15th inst., on behalf of its members, deposited with the Railway Rates Tribunal objections to the schedule of standard charges proposed by the four railway groups.

The Boilermakers' Lock-out.—The Boilermakers' Union has called a national conference of delegates at York, on October 23rd, to discuss the present position of the dispute. The conference is expected to define the attitude of the union with regard to the national overtime and night-shift agreement, which, up to the present, the boilermakers, alone among the various shipyard unions, have refused to operate.

Canadian Contracts.—A *Reuter* dispatch from Victoria, B.C., dated September 29th, stated that Mr. James Paterson, Parliament Buildings, Victoria, had called for tenders for electrical equipment, the supply of induction motors, transformers, &c., for the Acute Building Mental Hospital, Essondale, B.C. Also that the Hollinger Consolidated Gold Mines, Timmins, Ontario, were receiving bids for the construction of buildings, and would be in the market at an early date for switchboards, transformers, meters, &c.

South African Batteries.—In spite of the fact that the raw materials have to be mainly imported—without Government support—the manufacture of dry batteries in South Africa has already, in the short space of three years, established itself as a conspicuous success. According to the *S.A. Mining & Engineering Journal*, the firm responsible for this creditable achievement is already casting covetous eyes on the overseas markets. The confidence of the partners in the Excelsior Dry Battery Co. (Messrs. E. Cotton-Lloyd and J. W. Grant) seems to have been justified; even South Africa, with her limited demand accounts for at least half a million cells each year, and it is stated that one of the most eminent firms of electrical material manufacturers in England has recently approached the firm with suggestions with regard to the sole agency for the Far East, India, and Australia.

Russian Notes.—*A Great Ukraine Electrical Factory.*—The Karkoff (formerly G.E.C.) electro-mechanical factory, which was removed from Riga in 1915, was before the war, and is now, says a Russian paper, the largest electro-mechanical factory in all Russia, and it is supplied with the most modern equipment. It is twice the size of the Petrograd (formerly Siemens-Schuckert) factory. Over a thousand lathes or benches are in use in this factory, each driven by a separate electric motor. There are electric cranes of 25,000 and 15,000 kg. lifting power. Throughout the period of the Imperialistic and civil war this factory lost none of its equipment or material, and recently its equipment has been extended and strengthened. It has retained most of its technical staff, which has trained new squads of qualified workmen. At present the factory produces large quantities of machinery, transformers, and other apparatus, and has orders in hand for goods to the value of 1,200,000 gold roubles. It is now engaged in the construction of new tramway motors, pump motors, and welding machines. It is beginning the construction of turbo-generators in co-operation with the Southern Machine Trust factories, besides the mass production of engine parts.

Tiflis Power Station.—Sixteen versts from Tiflis, says a Russian official journal, the construction of the Zemo-Avtchalskoi hydro-electric station is proceeding. It is intended to electrify the town of Tiflis and district, and its capacity is 37,000 h.p. It will, with extensions, light all Tiflis, drive the tramways and industrial machinery, and provide for domestic heating and cooking. Its water-power will be derived from the river Kura. Existing stations are driven by petroleum or coal and the engineer—Melik Palayeva—calculates the saving in fuel to be effected by the new water-power station at 6,500,000 gold roubles per annum. Meanwhile, however, the struggle to obtain money to construct the new station is severe. It is expected to be completed in 1925.

New Power Station at Luga.—A Russian journal announces the completion of a new power station of considerable capacity at Luga.

Catalogues Wanted.—Messrs. Leonard Toomer & Co., of 54, Lower Thames Street, London, E.C.3, ask for latest catalogues of wireless sets and parts, also electric light fittings and accessories.

The Huddersfield Wholesale Electric Co., which has commenced business as electrical factors at 28, Ramsden Street, Huddersfield, wishes to receive manufacturers' catalogues.

"The Gondoliers."—Callender's "Anchor" Cable Works Musical Society, Leigh, established four years ago, attracted crowded houses to the local Hippodrome every night last week with their production of the Gilbert and Sullivan opera "The Gondoliers." On the Wednesday night, Sir Tom Callender, accompanied by members of the London and Leigh management, shared the enjoyment of the delighted house. Over 1,300 school children were present at the Friday's performance, which was under the patronage of the Mayor and Mayoress of Leigh. The week's "show" was an unqualified success, and fully justified the "Anchor" Society's commendable enterprise.

The World Power Conference.—Sir George A. Touche, writing with reference to this conference, says:—"If no other advantage results than an international standardisation of the commoner power devices, thus simplifying and cheapening production, the calling of this First World Power Conference will be a notable achievement for British initiative."

British Trade-Mark Applications.—The following are among the recent applications for British trade marks. Objections to any of the proposed marks may be entered within one month from the dates mentioned. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Neutrodyne. No. 438,355. Class 8.—Apparatus and instruments for wireless telegraphy and telephony. Louis A. Hazeltine, 511, River Street, Hoboken, N.J., U.S.A. (Cruickshank and Fairweather, 65-6, Chancery Lane, London, W.C.) October 10th, 1923.

Design. No. 439,220. Class 8.—Electric batteries and cells for the same. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W. October 10th, 1923.

Sparkophone. No. 439,510. Class 8.—Testing instruments for use in connection with sparking plugs. Simms Motor Units (1920), Ltd., Percy Buildings, Gresse Street, Rathbone Place, London, W.1. October 10th, 1923.

Whealf. No. 439,622. Class 8.—Crystal detectors for use in wireless telegraphy and telephony. Albert Hinderlich, trading as A. Hinderlich, 1, Lechmere Road, London, N.W.2. October 10th, 1923.

Ghane. No. 439,667. Class 8.—Crystal detectors for use in wireless telegraphy and telephony. Albert Hinderlich, trading as A. Hinderlich, 1, Lechmere Road, London, N.W.2. October 10th, 1923.

Radieco. No. 440,005. Class 8.—Apparatus for use in connection with wireless telegraphy and telephony. Frederick A. Mayer, trading as the Radio Equipment Co., Stilemans Works, High Street, Wickford. October 10th, 1923.

Strike in Upper Silesia.—A big strike has broken out in Polish Upper Silesia involving the mines, railroads, postal, telegraph and telephone services, gas and electricity supplies, and the interurban tramway systems. So far there has been no rioting and no damage has been done to property.—*Reuter* (Warsaw).

Engineering Trade Reports.—In their report for the year ended June 30th, Messrs. Stothert & Pitt, Ld., state that owing to the shortage of orders during the first nine months of the year a large number of employés had to be suspended, and the remainder put on short time, and to minimise unemployment as far as possible certain relief work was started. Such work found employment for a large number of the company's men throughout the winter months. The directors are pleased to state that a considerable number of contracts have been taken during the past five months, and all departments of the works are now working full time.

The directors of Agricultural & General Engineers, Ltd., in their report for the year ended March, 1923, show a loss of £10,429, attributable to the fact that several of the associated companies, having made losses, cannot declare a dividend, and that no interest has been charged to the associated companies on the sums advanced them. The stock at March last is to be again drastically written down by the associated companies, with the result that the combined trading of the 14 companies shows a loss of £145,525, of which £65,735 represents the writing-down of stock. During the four years of operation there has accumulated in the associated companies' books a total trading loss of £252,125. Owing to the trade depression about 25 per cent. of the normal producing facilities of the companies are in use. The investments in these companies should be accordingly written down to £1,750,000, which is approximately the net value of the assets of the associated companies. It is proposed that the deficiency of £1,233,115 be adjusted by writing down the value of the ordinary shares from 20s. to 10s. per share. The first and second preference shareholders are to be asked to waive all arrears of interest, as well as that for the year to March 31st next. In consideration it is proposed that the ordinary shareholders surrender approximately 15 per cent. of their holding to the first and second preference shareholders, the former receiving one ordinary share of 10s. for every three preference shares held, and the latter receiving one ordinary share of 10s. for every nine second preference shares held.

Canadian Electrical Imports.—During the month of August Canada imported electrical apparatus to the value of $1,151,695, of which $995,905 value was from the United States and $60,841 from the United Kingdom. The Netherlands supplied the largest quantity of incandescent lamps imported during the month, viz., $50,709 value, whilst similar imports from Japan totalled $15,908, from Belgium $13,674, from the United States $6,700, and from the United Kingdom $2,591.—*Reuter's Trade Service* (Ottawa).

Battery Prices Reduced.—The Chloride Electrical Storage Co., Ltd., announces considerable reductions in prices of "Exide" batteries.

Swiss Cutting of Export Order Prices.—In the course of a dispatch on "Swiss Industrial Problems," the Geneva Special Correspondent of *The Times Trade Supplement* says: "Serious complaints are being made about the high cost of labour. A Zurich engineering firm, in announcing the receipt of some important foreign orders, states that it has been obliged to accept them at prices which do not admit of the payment of current rates of wages. At the same time there is a movement towards the adoption of a longer working day. A resolution was recently passed by an influential body calling for the revision of the Factory Act with a view to strengthening the capacity of Swiss industries that are struggling against foreign competition and as a means of reducing the cost of production, and thus the expenses of living. The revision was not intended as an attack on the general principle of the eight-hour day, which would remain in operation wherever it was justified and economically possible."

London Dock Approaches.—The London Chamber of Commerce has arranged a public meeting, to take place on Tuesday next, at 2.30 p.m., in the Great Hall, Cannon Street Hotel, to consider certain proposals for improving the present inadequate approaches to the docks of the Port of London and the means best calculated to give effect to any decision which may be reached.

Trade Conditions in Germany.—The Commercial Secretary at Berlin (Mr. J. W. F. Thelwall) has forwarded to the Department of Overseas Trade a review based on the reports of the Prussian Chambers of Commerce on trade and industry during September. The metal market was adversely affected by the general situation. German metal prices have, in part, risen above the world's market level. This applies specially to lead. The metal industry continued to limit its purchases and only to cover absolutely essential requirements, with the result that a minimum amount of business was transacted in the month under review. In the aluminium industry in Lüdenscheid and neighbourhood employment was poor. Inland and foreign sales were bad, as the purchasing power of the inland population has declined still further and increasing foreign competition renders export more and more difficult. The Customs policy of foreign countries also hampered export. The same applies to other products of the Lüdenscheid finished metal goods industry. As regards locomotive construction, neither inland nor foreign orders came in, and not even inquiries to any extent worth mentioning were received. Competition with foreign countries became increasingly difficult. Orders of the Reich railways were still on hand, and will give employment for some time. For the rest, repairs were carried out. Dismissal of workmen is not yet necessary. The position of the electrical industry became worse, particularly as the cutting off of the occupied territory has greatly restricted the market for its products. Customers could, in part, no longer raise the requisite capital for new orders. Practically no extensions of industrial plant and power stations are being carried out. Prices have exceeded those of the world's market.

A Bombay Boycott.—A *Reuter* dispatch from Bombay states that the Bombay Municipal Corporation has by an overwhelming vote passed a resolution in favour of boycotting British Empire goods as a protest against the Imperial Government's decision regarding Indians in Kenya.

British Orders Sent to Sweden.—According to *Svenska Dagbladet* Allmaenna Svenska Elektriska Aktiebolaget, after keen competition, has obtained from England an order for 25 single-phase transformers for outdoor mounting.—*Reuter's Trade Service* (Stockholm).

The Swedish Locomotive Contract.—A *Reuter's Trade Service* dispatch from Stockholm says that the Railway Board, in referring to the Government the question of ordering fifty electric locomotives for the Stockholm-Gothenburg line, asks for authorisation to accept the offer of a Swedish combine amounting to 210,000 kr. per locomotive. This price, which is the result of negotiations between the Railway Board and the combine, is lower than that quoted by the combine in its tender handed in on September 17th. The Swedish combine consists of the following companies: Allmaenna Svenska Elektriska Aktiebolaget, Aktiebolaget Lindholmen-Lotala, Nya Luth och Rosens Elektriska Aktiebolag, Svenska Jaernvaegsverkstaederna and Aktiebolaget Nydqvist and Holm. The prices quoted by Swedish, Swiss and German tenderers were given in our issue of October 8th, p. 487.

The Government has authorised the Board of the State Railways to accept the Swedish combine's offer of fifty electric locomotives for the Stockholm-Gothenburg line at the rate of 210,000 kr. each.—*Reuter's Trade Service* (Stockholm).

Unemployment.—The number of persons on October 8th, 1923, recorded on the live registers of the Employment Exchanges in Great Britain was 1,251,600. This was 5,418 more than in the preceding week, but 234,278 less than the figure recorded on January 1st, 1923. The total included—934,300 men, 43,800 boys, 233,500 women, and 40,000 girls. In addition, the number working systematic short-time and drawing benefit for intervals of unemployment was 66,200 on October 8th, as compared with 73,702 on October 1st, and 56,261 on January 1st, 1923.—*The Times.*

Threatened Strike at Fulham.—At a meeting of members of the Fulham, Hammersmith and Battersea branches of the Electrical Trade Union it was resolved to ask the Fulham Borough Council to revert to the payment of time rates instead of piece rates to the Council's dustmen, who are at present on strike. Failing this it was decided to call a strike of power-station employés, and the Battersea and Hammersmith branches agreed that all bulk supplies to Fulham should be stopped.

Indian Trade Inquiries.—The Department of Overseas Trade notifies all concerned that the new Trade Commissioner office at Bombay was opened by Major Clarke in Exchange Building, Ballard Estate, on October 1st. Communications should be addressed: Major R. W. Clarke, H.M. Trade Commissioner, P.O. Box 815, Bombay.

New Showrooms, &c., for Hackney.—The Electricity Committee of the Hackney Borough Council has recommended, and the Finance Committee has approved application to the Electricity Commissioners for sanction to borrow £26,000 for the erection of new showrooms and offices for the electricity department. The amount is made up as follows: Cost of building, £20,000; equipment, £4,000; and workshops, £2,000.

The Damage to the Tokio Electric Undertaking.—The Whitehall Trust has received the following cable from the Tokio Electric Light Co.:—

"Hydraulic power stations and transmission lines, including underground cables, all safe. Out of 70 transforming and substations in Tokio and Yokohama twelve small stations destroyed. Out of 100,000 poles for distribution of system in Tokio and Yokohama 35,000 destroyed. In unaffected parts of Tokio and Yokohama service already resumed. In destroyed area company's general restoration work actively making progress."

Railways and Unemployment.—In view of the criticism which has lately been made regarding the apparent unwillingness of the railway companies to proceed with new works, the London & North-Eastern Railway Co. has issued a statement setting forth the arrangements which it has in hand or is projecting. The 1923 programme has been extended to include 108 instead of 78 locomotives, apart from extra tenders, coaches and wagons. The 1924 programme will include the construction of 154 locomotives, representing an expenditure of £880,000. Several million pounds is to be expended upon permanent-way and new works. Among the latter may be mentioned new machinery for the Doncaster shops and new boilers, conveyors, and other machinery at the Immingham power station (£43,000).

It is said that exhaustive consideration is being given to the question of the electrification of the lines from King's Cross to Welwyn Garden City and Hertford, but the preparation of the elaborate specifications is necessarily taking a great deal of time.

Local Exhibitions.—Holmfirth (Yorks.).—A public exhibition of domestic and other electrical equipment was held recently at the District Council offices, with a view to extending the business of the local electricity undertaking. Wireless demonstrations were an attractive feature of the exhibition.

Newport (Mon.).—A large electrical exhibition was opened by the Mayor (Mr. Edward Davies, J.P.) last week. It is housed in the Pavilion, Stowhill, a building measuring 170 ft. by 100 ft. The chairman of the Electricity Committee, at the opening ceremony, spoke of the success of the electricity undertaking, which earned a profit of over £22,000 in the last trading year. The exhibition, which closes to-morrow (Saturday), is a comprehensive show, in which 23 firms have participated, apart from two stands arranged by the Corporation Electricity Department. All classes of domestic appliances—heating, cooking, labour-saving, and lighting— are on view. The exhibition is attracting a good deal of public attention; a pleasing feature is the notice which it has received from the South Wales newspaper Press.

Calendar.—The Chloride Electrical Storage Co., Ltd., has issued a large pictorial calendar with twelve monthly slips commencing with November. The upper part is a reproduction of a drawing by "Barribal," entitled "The 'Exide' Girl."

New French Companies.—There has been formed at Paris (57, Rue Pierre Charron) the Société Pour le Développement des Véhicules Electriques, for the furthering of the use of electric accumulator-driven vehicles of all kinds. The capital at present is fixed at 1,400,000 fr., but can be increased later to 4,000,000 fr. Twelve leading electrical companies of Paris and Lyons are represented on the first board of directors.

A new company has lately been formed in Paris (59, Rue Saint Lazare) with a capital of 900,000 fr., and the title La Compagnie Française des Accumulateurs Electriques "Phœnix."

Conditions in Argentina.—In a review of economic conditions in Rosario and Northern Argentina, appearing in *Commerce Reports*, the U.S. Consul at Rosario states that exchange rates and pending tariff legislation have had an adverse effect upon import trade. On the other hand, export trade has recently been very active. There has been an increase in the number of building and engineering enterprises, business having become adjusted to the higher scale of prices and labour costs. Electric lighting plant in country towns has proved to be a good local investment, and ten or twelve such stations are projected.

For Sale.—Messrs. H. Butcher & Co. will sell by auction, on November 6th and following day, at the Auction Rooms, 586, Oxford Street, W., a quantity of electrical stores and accessories. (See our advertisement pages to-day.)

Electricians' Wages.—In accordance with previous notice the Trade Union representatives upon District Council No. 2 for the Electricity Supply Industry (Yorkshire, &c.), on October 10th, put forward an application for an increase of 1d. per hour in the wages of all grades of employés. After considerable discussion the following motion was made by the employers' side:—"That in view of the recent Award 767 of the Industrial Court, the present is not an opportune time for granting any increase in the rates of pay to those grades set forth in the District Council's Schedule." The voting being equal the motion was not carried, and no agreement was reached in the matter.

Private Arrangement.—George Wilfred Neate, electrical engineer, 55, Hartland Road, London, N.W.—The creditors interested herein were called together on October 10th at the offices of Messrs. Corfield & Cripwell, accountants and auditors, Balfour House, Finsbury Pavement, London, E.C., when a statement of affairs was presented, which disclosed liabilities of £273, of which £241 was due to the trade, while the balance of £32 was due to cash creditors. The net assets were £32, or a deficiency of £241. It would appear that the debtor started trading in 1918. He had a partner soon after he commenced, but there was a dissolution in 1920. He took another partner, but the latter left and went abroad. The present position was attributed to bad debts. An offer was made of a composition of 5s. in the pound in cash, and, after discussing the matter, it was decided to accept the offer, subject to the debtor assigning a book debt to Mr. William Osborne, of Messrs. Corfield & Cripwell, on behalf of the creditors.

British Empire Exhibition Notes.—The Exhibition Authorities are inclined to abandon all idea of issuing competitive awards to exhibitors, and instead thereof to present commemorative medals to all. They are trying to ascertain whether this idea will meet with the approval of all parties interested. If the general opinion does not coincide with the authorities' view awards in each particular section will probably be made by a jury appointed by the exhibitors therein.

The Barnes Urban District Council has received the permission of the Electricity Commissioners to contribute a sum not exceeding £80 towards the expenses of the electrical display which is being arranged by the British Electrical Development Association.

The London Electric Firm, of Croydon, will be exhibiting at Wembley searchlights, lamp-lowering gear, electric heating apparatus, and other lines.

LIGHTING AND POWER NOTES.

Barnsley.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £3,100 for mains.

Birmingham.—Unemployment Relief Schemes.—The Corporation has approved a number of schemes for providing work for the unemployed during the coming winter, including the following:—Installation of electric lighting at 24 schools, £10,850; electric lighting at 11 libraries, £1,100; laying of e.h.p. mains between Nechells and Summer Lane generating stations, £9,550; and mains extensions in the outer parts of the city, £30,550.

Bradford.—Year's Working.—The accounts of the city electricity undertaking (engineer: Mr. T. Roles) for the year ended March 31st last record a total income of £471,829, as compared with £444,013 in the previous year. The working expenditure totalled £235,981, as against £299,400, leaving a gross profit of £235,848 (£144,613). Although the capital charges increased by about £12,000, the result was an increase in net profit from £8,317 to £88,717. Of this amount £35,662, as against £4,826 in 1921-22, was transferred to reserve.

The capital account shows that £301,790 was spent out of loans during the year, in addition to £54,330 from revenue. Of these amounts £192,574 was spent on buildings and plant at the Valley Road station; and £96,151 on mains and services.

The generating statistics show that the maximum load rose from 27,213 to 31,518 kW, while the plant capacity remained at 39,000 kW. The sales of energy increased from 53,297,419 to 65,456,551 kWh.

The report states that a new turbo-generator set is in course of construction. This will have a normal rating of 16,000 kW, and a maximum continuous rating of 20,000 kW; it will run at 3,000 r.p.m. The turbine is being built by the English Electric Co., Ltd., and the generator by Messrs. C. A. Parsons & Co., Ltd.

Cardiff.—Year's Working.—The accounts of the city electricity supply undertaking (engineer: Mr. C. G. Morley New) for the year ended March 31st last record a total income of £181,335, comparing with £168,370 in the previous year. Working expenses fell from £117,404 to £84,215, leaving a gross profit of £97,120, as against £50,966 in 1921-22. The final result was a net profit of £39,436, a large increase upon that of the previous year—£21,517. Capital expenditure during the year amounted to £55,491, the largest single item being £28,403 for mains and services.

The engineer's report shows that the sales increased from 11,967,013 to 15,474,393 kWh. The maximum load rose from 3,578 to 8,845 kW, and the load factor improved from 16.70 to 19.97 per cent. During the year, after some delay, a new 1,000-kW turbo-alternator was put into service, and the reconstruction of the original boiler house was commenced. The work of changing over the supply in the Roath district from 40 to 50 cycles proceeded, and only a comparatively small 40-cycle network remains.

Continental.—Scandinavia.—Three plans have been prepared by representatives of the three Scandinavian countries for the transmission of electricity from Norway to Denmark. The first scheme comprises the transmission of a 200,000-V continuous current by means of cables from Southern Norway through Skagerrak to Jutland, thence by overhead conductors to Aarhus, and through the Little and Great Belts to Zealand and Copenhagen, where the electricity is to be transformed to a.c. The waterfalls of Kviken and Otra, near the Norwegian south coast, will be utilised for generating electricity. The second scheme is intended to transmit electricity through Sweden as far as Helsingborg through the Sound, and then through Denmark. A large power station is being erected near the Nore cataract, from which the electricity supply will be obtained. Another overhead transmission line through Sweden is included in the third scheme. It is anticipated that 150,000 h.p. will be obtained, and the price per kW as distributed throughout Denmark will be from 180 to 270 kronen. The three schemes are to be submitted to the Governments concerned.—*Manchester Guardian Commercial.*

Darlington.—Loan.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £20,326 for mains and services.

Edinburgh.—Year's Working.—The accounts of the city electricity department (engineer: Mr. F. A. Newington) for the year ended May 15th last show that the revenue of the undertaking was £417,812. The working expenses absorbed £221,966, leaving a gross surplus of £195,846. In 1921-22 the equivalent figures were:—Revenue, £395,091; expenditure, £242,512; and surplus, £152,579. After meeting capital charges, &c., the net profit for the year was £46,449, as compared with £30,714 in the preceding year. The capital account shows a total expenditure for the year of £567,248, the main item being £322,781 on account of machinery and plant for the new Portobello station. The amount of energy sold increased from 33,935,455 to 42,206,150 kWh. A large increase occurred in the traction consumption, from 1,009,296 to 4,783,650 kWh.

Hereford.—Loans Sanctioned.—The Town Council has received sanction to loans of £25,375 for electricity purposes, £3,000 for extensions, and £1,032 for mains. The Commissioners have asked for further information regarding a loan of £6,251 applied for, and which had been expended on materials in stock, obtained for works which had been abandoned, and also regarding another £7,000 applied for.

Electricity in Bulk.—The Council has received an application from Abergavenny for a supply of electricity in bulk, and the consulting engineer to that authority is to meet the electrical engineer on the subject.

Irish Free State.—Wicklow.—The electricity undertaking was recently formally inaugurated by the chairman of the Urban District Council. The cost of the scheme was £6,000.

Clonakilty (Co. Cork).—The local electricity supply company is disposing of its entire plant with a view to the installation of machinery with a larger capacity.

India.—Madura.—The question of the city electricity supply scheme was again discussed at a recent meeting of the Municipal Council. It was eventually decided to report to the Government that the Council was willing to undertake the scheme itself, provided that the Government contributed three lakhs of rupees as a grant and a further sum of three lakhs as a loan. Otherwise, the Council urged the grant of a loan of one lakh to enable it to take shares in the company as originally resolved and approved by Government. In the original scheme a clause provided that at the expiry of 30 years, or even earlier, the municipality could take over the scheme itself by buying out the whole of the shares of the company.—*Indian Engineering.*

London.—Interchange of Power.—The Highways Committee of the London County Council advises the modification of the agreement between the Council and the London Electric Supply Corporation, Ltd., which has been in force for some years, to allow of the interchange of as much as 10,000 kW. The existing cables are only of sufficient capacity to carry 5,000 kW, and it is therefore recommended that larger cables be installed at a cost of £10,200, to be borne equally by the Council and the company.

Marlborough.—Additional Plant.—The Town Council has entered into an agreement with Marlborough College for the installation of additional plant at the college generating station for a public supply of electricity. The agreement is to continue for 10 years.

Middlesbrough.—Electricity Supply.—The Corporation has completed the work in connection with the electricity supply to Marton-in-Cleveland, and is negotiating with a view to extending its area of supply to Nunthorpe.

New Zealand.—Wellington.—The municipality has received a report from Mr. E. Parry, of the English Electric Co., on the proposed change-over of the system of electricity supply. He recommends that the present voltage of 100 be changed to the New Zealand standard voltage of 230. The estimated cost of carrying out the scheme is £163,532.—*Reuter's Trade Service* (Melbourne).

Dunedin.—The Municipal Council is extending its Waipori Falls station, now of 6,000-kW capacity, by the addition of a 3,000-kW generating set, with provision ultimately for three more such sets, and arrangements have been made whereby it will give a supply over the Government transmission lines.

Lake Coleridge Scheme.—The plans have been completed for the extension of the Lake Coleridge power station by the addition of two 7,000-kW generating sets, and the work will be commenced as soon as a contract has been entered into with Christchurch City Council to take the power.

Portsmouth.—Loan Sanctioned.—The Town Council has received sanction to a loan of £12,500 for laying mains along the route of a proposed new road to Hilsea Lines.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

Bury St. Edmunds.—Power: First 500 kWh, 5½d. per kWh; 500 to 2,500, 3¾d. per kWh; 2,500 to 5,000, 3½d. per kWh; 5,000 to 7,500, 3d. per kWh; 7,500 to 10,000, 2½d. per kWh; beyond, 2d. per kWh, less 15 per cent.

Holmfirth.—Heating and cooking: Where supplied through a separate meter, 2½d. per kWh for the first 100 kWh per quarter, and 2d. per kWh beyond that amount, plus meter rent.

Whitby.—Heating and cooking: First 100 kWh per quarter, 3d. per kWh; next 100 kWh, 2d. per kWh; all energy in excess of this amount, 1½d. per kWh.

Radcliffe (Lancs.).—Loan Sanctioned.—The Urban District Council has received the sanction of the Electricity Commissioners to the borrowing of £4,211 for additional converting plant.

Redcar.—Special Order.—The Corporation has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the district.

Ripon.—Proposed Electricity Supply.—The City Council is taking a referendum of the ratepayers with regard to a proposed electricity supply for the district. The consulting engineer recommends: (*a*) the utilisation of a portion of the existing gasworks as a power station; (*b*) that the dynamos be run by engines fed from the tows's gas supply; (*c*) that the electrical plant be operated by the present gasworks staff; (*d*) that a d.c. three-wire system, with 230 V for lighting and 460 V for power, be adopted. It is estimated that the initial capital expenditure will be £6,100 and the running costs, including loan charges, &c., for the first year, £883, but after a year it is expected that it may be necessary to install an additional generating set at an estimated cost of about £2,750, with further mains and meters (£1,140), so that a total of £10,000 is required.

Rothesay.—Electricity Supply.—The Town Council has received the sanction of the Electricity Commissioners to an electricity supply for the district, and is negotiating with the Rothesay Tramways Co. for a supply for a period of five years.

Rugeley.—Proposed Electricity Scheme.—The Urban District Council has received a report from Mr. W. H. Robbins, electrical engineer to the Stafford Corporation, on the proposed electricity scheme for the district. He recommends the Council to apply to the Electricity Commissioners for an Order authorising it to supply electricity in the district and to arrange for a bulk supply from either Wolverhampton or Cannock.

Special Orders.—The Electricity Commissioners have submitted to the Ministry of Transport for confirmation Special Orders granted to Mr. G. B. Smith, for the supply of electricity within the urban district of Seaton, and parts of the rural district of Axminster, and to Wakefield Town Council for the supply of electricity to Lupset.

Sheffield.—Wiring of Small Houses.—With the object of encouraging the use of electricity, the Electricity Committee has secured the sanction of the Corporation to allocate £10,000 from the renewals fund for the wiring and fitting of about 2,000 working-class houses. It is estimated that it will be possible to wire and fix five points, with fittings, globes, &c., at a cost of £4 10s. per house.

Sunderland.—New Plant.—The Town Council has adopted recommendations of the Electricity Committee for extensions to plant and mains costing £161,080, subject to a grant being received from the Unemployment Grants Committee towards the scheme, and also subject to the Electricity Commissioners postponing for the first few years the commencement of sinking fund payments. The Committee proposes to install a new 10,000-kW turbo-generator, complete with condensing plant, switchgear, steam pipes, air filter, and foundations, at an estimated cost of £50,800, also water-tube boilers, super-

heaters, economisers, mechanical stokers, pumps, water-evaporating plant, air compressor, &c., at an estimated cost of £60,165; to erect natural draught cooling towers and pipe-work connections, costing £17,615, and to extend mains at an estimated cost of £32,500.

Turkestan.—Electricity Scheme.—A delegation of the Moscow Elektrotrust has arrived in Turkestan, according to the *Ost Express*, in order to examine the conditions for the electrification of Turkestan, for which purpose an agreement has already been concluded between the State Economic Committee and the Turkestan State Trading Bureau. According to this agreement, the Elektrotrust undertakes the erection of a power station and the supply of machinery, turbo-generators, transformers, &c. It is proposed to erect a power station, with a capacity of 4,500 h.p., at Tashkent, the capital of Turkestan.—*Reuter's Trade Service* (Moscow).

Wardle.—Electricity Order.—The Urban District Council is applying to the Electricity Commissioners for an Electricity Order, authorising it to supply electricity in the district. If the application is approved, the powers will be transferred to Rochdale Corporation.

Wareham.—The Town Council has entered into an agreement with the Electric Supply Co., Ltd., for public lighting for five years.

Whitehaven.—Loans.—The Town Council has applied to the Electricity Commissioners for sanction to loans of £1,500 for meters and £2,500 for services.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—Track Renewals.—The Corporation proposes to renew certain portions of the tramway track within the town at an estimated cost of £74,326, with a view to providing work for the unemployed.

Bradford. — Weekly Tramway Passes. — The system of weekly tramway passes having proved successful on certain routes, the Town Council has approved the adoption of the scheme on all routes in the borough, as from October 29th, for a trial period of three months.

Darlington.—New Route.—The Tramway Committee has under consideration a proposal to extend the tramway system to Haughton-le-Skerne.

Dearne Light Railways.—The construction of the Dearne District Light Railways—the scheme of municipal tramways promoted by the Urban District Councils of Wath, Wombwell, Bolton-on-Dearne, and Thurnscoe—has reached an advanced stage. Rails are now being laid through Wath, and that Council has decided to borrow £37,750, being the whole of its proportion of the capital cost of the scheme, and to pay the full amount to the Light Railway Committee's account, in order to relieve the other authorities from borrowing at present.—*Electric Railway and Tramway Journal.*

Edinburgh.—New Route.—The Town Council is applying to the Ministry of Transport for authority to continue the tramways from Bernard Street through Salamander Street to Seafield.

London.—Collision.—Eight persons were injured in a collision between a tramcar and a motor-'bus in Clapham Road, S.W., on October 10th. The 'bus sustained severe damage, the upper deck being badly smashed, while one of the springs was broken. All the injured persons were travelling on the motor-'bus.

L.C.C. Tramways.—The Highways Committee of the London County Council reports that the Council's consulting engineer (Mr. J. H. Rider), in consultation with the tramway department electrical engineer, has advised the installation of a 15,000-kW turbo-generator at the Greenwich power station in preference to taking a bulk supply from an outside source. The Finance Committee has concurred in the expenditure involved, and the consent of the Electricity Commissioners to the installation of the new plant has been obtained.

TELEGRAPH & TELEPHONE NOTES.

Brazil. — Cable Concession Cancelled. — The Brazilian Government has cancelled a concession granted to the Western Union Telegraph Co. on July 13th, 1918, for the construction and operation of submarine cables from Nichteroy to the West Indies and from Nichteroy to Uruguay, on account of the failure to begin work within five years from the date of the contract.—*Commerce Reports.*

Germany.—Long-distance Telephony.—According to *Commerce Reports* work is in progress on the Koenigsberg-Libau cable, which, when completed, will put Berlin in direct telephone communication with Riga. It is expected that the circuit will be in operation within the next two months.

India.—Madras-Rangoon Radio Scheme.—Work is proceeding rapidly in connection with the Madras-Rangoon scheme. All the necessary machinery and apparatus for converting the old Madras wireless station for this purpose have been received and the station has been temporarily closed down and a new station at St. Thomas's Mount took over all traffic from August 1st. A large staff has been transferred to Madras from different centres in India for the purpose of supervising the reconstruction of the station. It is hoped that the new station will be ready to commence work well before the end of the year. Meanwhile the St. Thomas's Mount station has been in communication with ships at sea and with Port Blair since August 1st.—*Indian Engineering.*

Imperial Communication.—Postmaster-General's Statement.—A recent session of the Imperial Economic Conference was opened with a statement by the Postmaster-General on the position of the Empire's mail, cable, and radio telegraph services. Sir L. Worthington-Evans reviewed recent and future developments, and claimed that mail and cable services had been restored almost, if not quite, to pre-war regularity and efficiency. He paid a tribute to the work of the Pacific Cable Board and the Eastern Telegraph Co. Whilst admitting that West Indian cable communication was not satisfactory, the Postmaster-General referred to a scheme (outlined below) which had been agreed to in principle for a new cable. Notwithstanding increases in working expenses cable rates had been reduced, and he hoped the process of reduction would continue; there was still considerable scope for it, especially in the case of long-distance messages. With regard to the Imperial radio telegraph stations, the Government station near Rugby would, he hoped, be ready for work before the end of next year, but they had not yet arrived at a satisfactory division of the services with the Marconi Co. It was essential that in parting with the monopoly which the Government possessed by statute, it should secure that a sufficient amount of commercial traffic was reserved for the station. All the Dominion representatives agreed that the quickening of means of communication was of vital importance, and that the Conference must leave no stone unturned to accomplish reform. The Conference adopted three resolutions: The first urged that representatives of the Dominions and India should be associated with the work of the Imperial Communications Committee when questions of interest to them were under consideration; the second pressed for all possible support to the State-owned Atlantic cable route, and the third asked that in any concessions given in the British Empire to private enterprise in respect of cable or radio services, including broadcasting stations, preference should be given to companies within the Empire.

Empire Press Union.—The Council of the Union met recently to consider representations to be made to the Imperial Economic Conference with a view to the improvement of Press communication. The chairman stated that in view of what appeared to be the deadlock in the negotiations between the Post Office and the Marconi Co. it was desirable that the Council should review the situation.

Poland.—Long-distance Radio Telegraphy.—A direct radio-telegraph service between Poland and the United States was inaugurated at Warsaw on the 4th inst.

West Indies.—Proposed New Cable.—In a statement which he made at the Imperial Conference, the Duke of Devonshire (Secretary of State for the Colonies) said that telegraphic communication between and with the West Indies had given rise to dissatisfaction for some time past. The question was discussed at the Conference at Ottawa in 1920. They had recently put before the Canadian and West Indian Governments concerned a scheme for an all-British cable from Turks Islands to Barbados, with subsidiary connections by cable and wireless telegraphy to the other Colonies, which scheme had been accepted in principle by all the contributory Governments, and he hoped that it would be carried out during the coming year.

This scheme would afford an opportunity for an even wider measure of inter-Imperial co-operation than the existing arrangement for joint contributions to the West India and Panama Cable Co.'s subsidy. The proposed cable was to be laid and maintained by or on behalf of all the Governments concerned, and it was proposed to ask the Pacific Cable Board to undertake the management and control of the cables and radio stations which would be maintained under the scheme; but the Board would have no financial responsibility in the matter. The *Birmingham Post* announces that a special meeting of the Board will be held on October 22nd to consider the proposal. It is expected that a new chairman of the Board, in succession to the late Sir H. Babington Smith, will be appointed before the coming meeting, and the office, it is said, will be given to a publicist with experience in the Post Office department in charge of Imperial telegraphy.

MANCHESTER CORPORATION ELECTRICITY WORKS.

THE BARTON POWER STATION.

Planned in 1914, but held up by the war, the new power station of the Manchester Corporation at Barton, in Trafford Park, was at last inaugurated on Thursday last week by the Earl of Derby, K.G., in the presence of some 350 spectators, including many distinguished engineers and members of manufacturing firms. During the long interval since its inception, the station, which has been built to the designs and under the supervision of Mr. S. L. Pearce, C.B.E., M.Sc.Tech., and the engineering staff of the Electricity Department, has been more or less completely re-designed, and now embodies the latest practice. The present installation comprises three Metropolitan-Vickers turbo-alternators, each of 14,375 kVA, and three 1,250-kVA sets by the British Thomson-Houston Co., Ltd., with Richardsons, Westgarth condensers and Allen pumps, nine Babcock & Wilcox 100,000-lb. boilers and economisers, with Davidson fans, six 19,500-kVA Metropolitan-Vickers three-phase transformers, and several smaller ones of the same make, B.T.H. cubicle and other switchgear, and cables by Callender's, who also made the 33,000-V feeder cables. The station buildings, erected by Messrs. E. Nuttall, Sons & Co., Ltd., with structural steel work by Sir Wm. Arrol & Co., Ltd., include a switch house on the canal bank, turbine house, and boiler house; the second half of the station will include similar buildings in the reverse order, so that the two boiler houses will be in the middle, flanked by two turbine rooms, and with two switch houses one at each end of the range. Ample wharfage and railway siding accommodation is provided, together with large outdoor coal silos, which are served by a complete equipment of coal conveyors. The present plant is rated at 82,500 kW, and the site is capable of development to 150,000 kW, but it is uncertain whether the additional plant will be installed on this site. Coal is obtainable by canal from the West Lancashire Coalfields, three or four miles away; circulating water is taken from the Ship Canal and returned to it at a point 600 yards from the intake.

Fig. 1.—An Aerial View of Barton Power Station.

A fully illustrated description of the station was printed in the Electrical Review of June 22nd, 1923, and an account of the proceedings at the opening ceremony appears elsewhere in this issue.

Fig. 2.—The Turbine Room, Barton Power Station.

AN ELECTRICALLY-EQUIPPED HARBOUR JETTY.

THE G.W.R. FOWEY INSTALLATION.

The recently inaugurated electrically-equipped jetty at Fowey Harbour, in Cornwall, which is the exporting centre of the china clay industry, is of considerable interest. The jetty and machinery, which were constructed and erected under the supervision of Mr. Roger T. Smith, M.I.E.E., chief electrical engineer of the Great Western Railway Co., represent an expenditure of nearly £300,000.

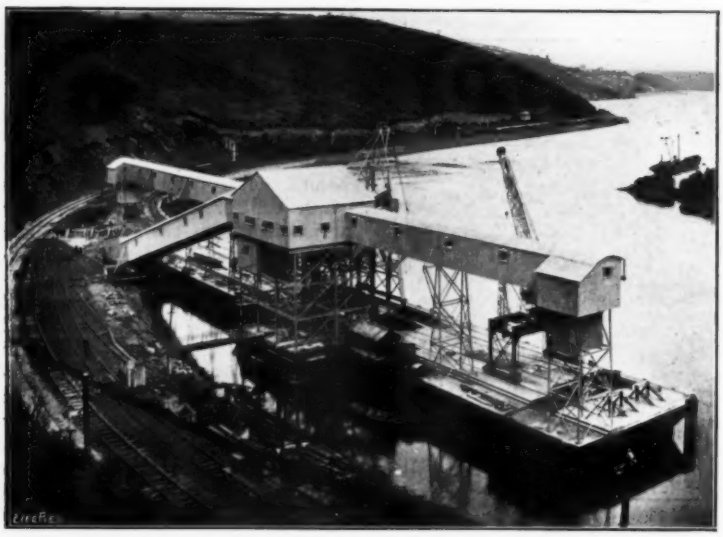

Fig. 1.—The Fowey Harbour Jetty.

The seven older jetties, being at right angles to the flow of the river, a ship in moving across the jetty end, had to be manœuvred so as to bring the hatchway of the hold that was to be filled opposite the tipping shoot, conveyor, or crane. Prior to the war the Great Western Railway built an eighth jetty of steel roughly parallel to the river flow in the bend opposite Mixstowe Mill, and in this case two vessels, whose combined length does not exceed 450 ft., or one vessel of that length, can lie alongside the jetty. In consequence, the conveyor shoot which delivers clay in bulk into the vessel must be able to travel up and down the jetty until opposite the hatchway of the ship's hold; similarly, the cranes must be able to travel along the jetty, which requirements account for the much more elaborate arrangements on No. 8 than those on jetty No. 4.

A steel silo having an outside diameter of 40 ft. and a steel and concrete lining 2 ft. 9 in. thick has been sunk to support the tipping table and driving machinery; the weight of the silo complete will be about 1,200 tons.

Wagons containing bulk clay are tipped over the silo, the clay passing into the hopper, and a troughed belt continuously moving within the sloping structure lifts the clay from the spout of the hopper to the top of the main tower. Other troughed belts moving in horizontal galleries carry the clay in one or other direction as required.

An electrically-driven moving structure spanning the two wagon roads on the jetty is provided, by means of which at any point in the moving belt opposite a ship's hold the clay can be diverted into a cross conveyor belt which carries the clay across the jetty. This belt is hinged so that the end next the ship can be raised and lowered to suit any size of ship at any state of the tide, the free end of the belt delivering into a long telescopic shoot which can be lowered into the hold. Within the ship's hold the shoot carries a revolving nose which can be turned in any direction so as to reduce the need for trimming the clay to a minimum.

The whole conveyor system will normally deliver 480 tons of bulk clay per hour into a ship's hold, the actual quantity being governed by the rate at which single wagons can be hauled by electric capstans from a waiting train on to the tipping table, tipped into the hopper below, and hauled away.

At present only one tipping table and line of conveyors, normally delivering 240 tons per hour, are being erected; but should the clay trade develop, then the wagon-tipping and conveyor plant can be duplicated in such a way that both holds of the biggest ship which can lie alongside will be loaded simultaneously, or one hold of each of two smaller ships lying stern to stern alongside the jetty can each be filled at once.

The conveyor electrical machinery is arranged to start and stop belts so that any one belt cannot become choked by being fed by a belt coming before it in the sequence. A breakdown of one belt-driving motor will stop all other motors running in sequence.

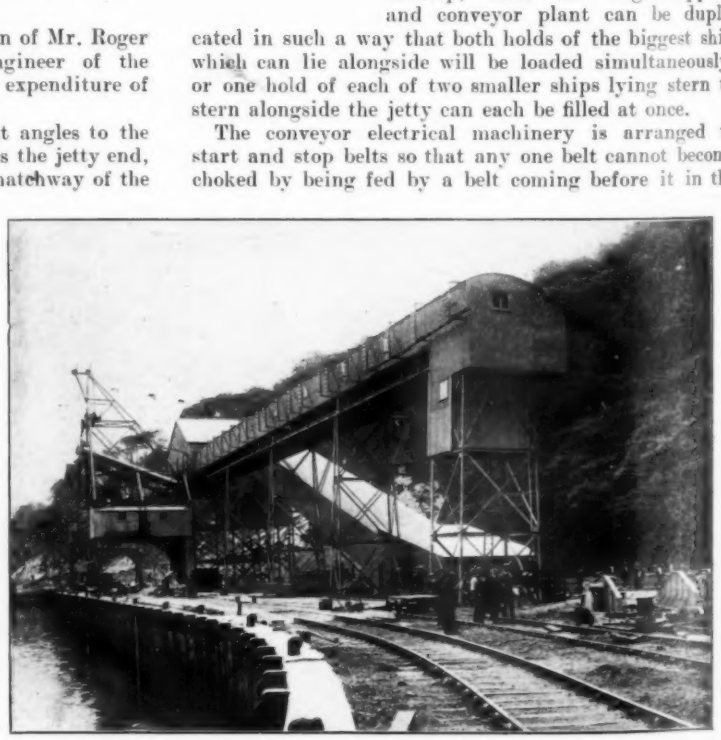

Fig. 2.—The Fowey Harbour Jetty.

The starting and stopping is done by simple push-button switches, and the gradual running up of the motors in the proper order is controlled by a system of electrical contactors of a pattern such as is used by the Admiralty for the steering gears of ships.

THE DUNDALK ELECTRICITY UNDERTAKING.

A LARGE DIESEL-ELECTRIC STATION.

The public supply of electricity in Dundalk was inaugurated in June, 1912, at a capital expenditure of £25,000, the plant comprising two 150-h.p., 3-cylinder Mirrlees Diesel oil engines, each coupled direct to a

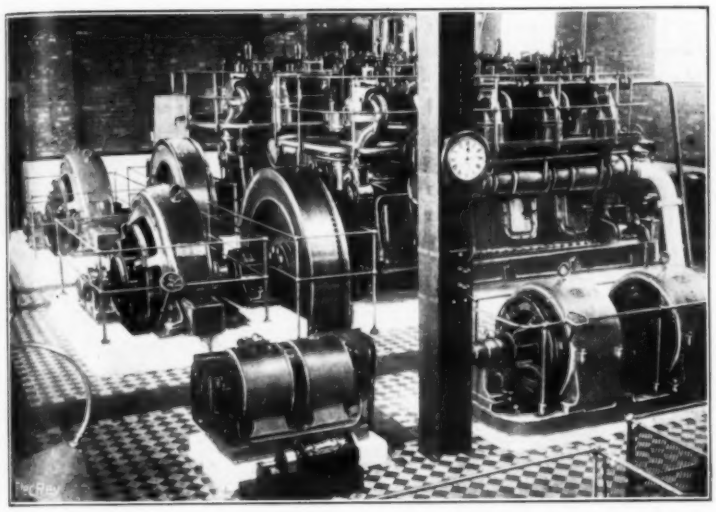

Fig. 1.—Plant Installed in 1915 and 1916.

100-kW Siemens dynamo, and a D.P. 600-Ah battery, together with a charging booster and a balancer. The direct current was distributed at 220 and 110 volts on the 3-wire system by means of paper-insulated and armoured cables laid direct under the footpaths in the main streets, and by bare overhead wires supported on steel poles in the outlying districts.

Public lighting was and is effected by means of cast-iron standards in the main streets, fed directly by the underground mains and controlled by a switch on each standard; and elsewhere by means of cast-iron

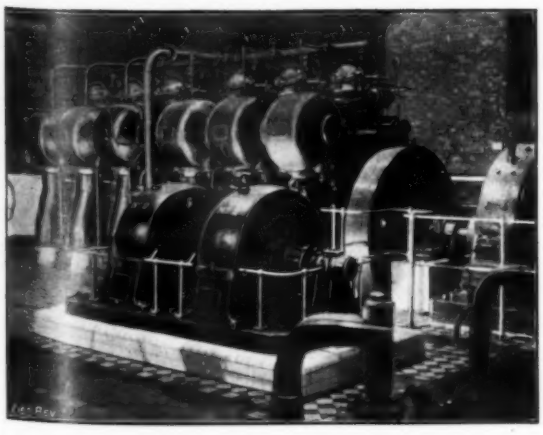

Fig. 3.—Rear View of New Set.

brackets secured to the steel transmission line poles and controlled in suitable groups of from 15 to 40 lamps each, by master switches. At the outset some 300 lamps were erected; additional lamps were provided from time to time, and at present there are 415 lamps in use. It is, in fact, no idle boast that Dundalk has now the best lighted streets of any provincial town in the Irish Free State.

During December, 1912, an additional Diesel engine generating set, similar to each of the original sets, was installed in order to cope with the growing demand for electricity.

In June, 1914, the Urban District Council entered into an agreement with the Great Northern Railway Co. (Ireland) to supply the whole of that company's local locomotive works with electricity for a period of 15 years. This supply involved an extra capital outlay of £21,000, and necessitated considerable extensions of the power station buildings and plant. Late during 1914 two additional generating sets, each consisting of a 320-b.h.p., 4-cylinder Mirrlees engine coupled direct to a 220-kW General Electric dynamo, were ordered, and special cables of large capacity were laid in duplicate, early in 1915, underground direct to the railway company's works. Owing to delays in consequence of the Great War, the second new

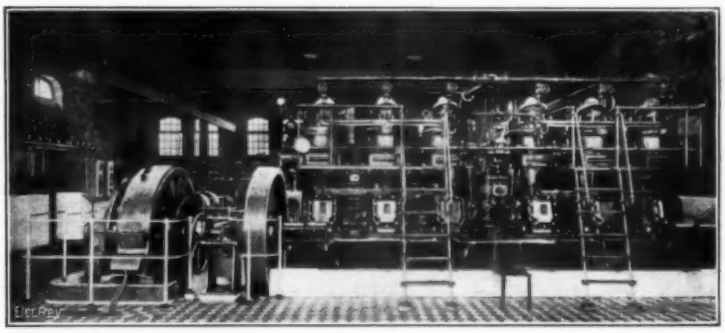

Fig. 2.—Front View of New Set.

generating set was not erected until late in 1916, the supply proper to the railway works being commenced in September of that year. The 1914 scheme of extensions also included the erection of new offices; an additional battery room, containing a 600-Ah D.P. battery of 240 cells; and a 100-kW Bruce Peebles reversible motor-generator set, together with a Lancashire reversible battery booster. A large steel tank capable of holding 125,000 gallons of fuel oil was also erected and was connected to the quay side by a 6-in. steel pipe line to enable fuel oil to be consigned in bulk and pumped direct from the boat into the storage tank. The latter and the pipe line together cost £1,450 to erect, and the total saving that this installation has effected in the cost of fuel oil, up to the present time, amounts to over £5,000—compared with what the oil would have cost if the original system of obtaining it in barrels had been continued.

Fig. 1 shows the two generating sets which were installed during the years 1915 and 1916, while fig. 4 is a view of the main switchboard as completed in 1915.

During each of the past three winters the entire generating plant was fully loaded, leaving no standby plant whatever, but owing to the abnormally high cost of machinery and labour during 1920 and 1921 the Urban District Council considered it inadvisable

to incur any heavy extra capital expenditure. Eventually, in May, 1922, the engine room was extended to accommodate new plant, provision also being made

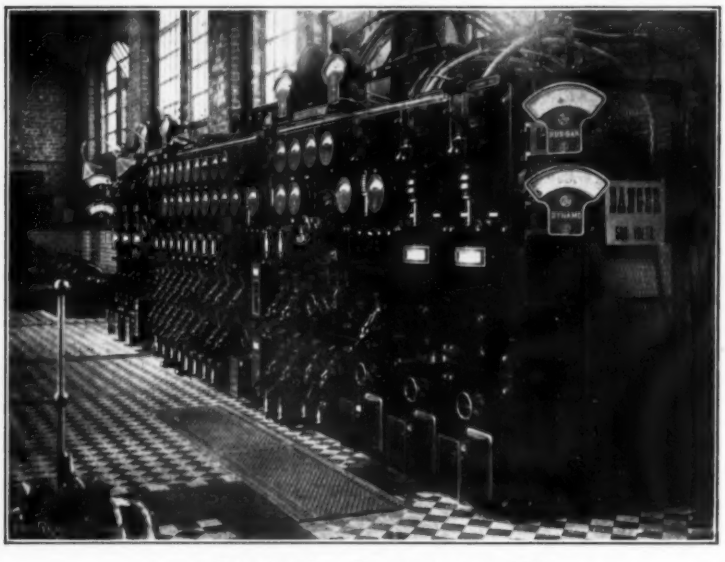

Fig. 4.—Main Switchboard in 1915.

so that more plant could be added at some future date without any further building extensions being necessary. The plant recently installed comprises one 510-

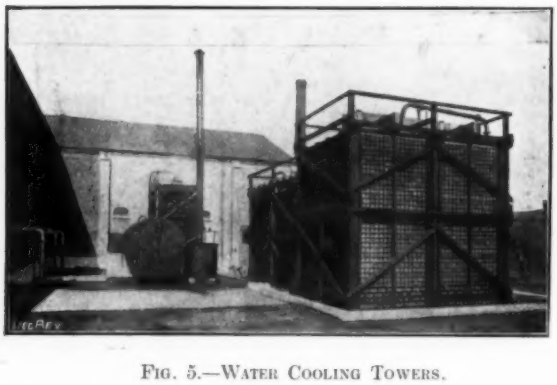

Fig. 5.—Water Cooling Towers.

b.h.p., 6-cylinder Vickers-Petters semi-Diesel engine (the largest of its type in the whole of Ireland), coupled direct to a Metropolitan-Vickers 340-kW shunt-wound, 530-volt, 250-r.p.m., d.c. dynamo; one 100-kW G.E.C. motor generator set; one 100-ampere M.-V. mid-wire balancer set; and extensions to the main switchboard which were carried out by the G.E. Co. The 500-volt battery was also completely overhauled and re-plated by the Premier Accumulator Co., Ltd., during the latter part of 1922. The total capital outlay on this recent extension amounted to £14,000.

The new engine represents a saving of no less than £6,000 in capital expenditure, as against the cost of an ordinary Diesel engine of the same size, and although the actual fuel and lubricating oil consumption is slightly higher for the engine selected, the net annual saving anticipated for it will be considerable and, therefore, its selection was justified. The complete absence of any valve gear on the main cylinders and the elimination of the air compressor—common to ordinary Diesel engines—should also result in far greater simplicity of working and, therefore, give more reliable running with this type of engine. The engine has an 18-in. stroke and a cylinder bore of 16 in.; the double eccentric shaft governor, which times the ignition and controls the supply of fuel, has enabled the water injection system of ignition regulation to be discarded. By means of the electric starter, the engine can be started instantly from cold, and, as an alternative, lamps are provided which enable the set to be started from cold in 60 seconds. The engine will work satisfactorily on any crude or residual oil, the specific gravity of which does not exceed 0.95; in addition, it can be made to burn tar and vegetable oils, and the provision of light-load gear, which ensures the vaporiser remaining incandescent and thus eliminates starting burners, makes it possible to run the set at no or light loads for any length of time.

The complete plant in the generating station now comprises six oil engines having a total output of 1,600 b.h.p., with a combined dynamo output of 1,080 kW, the station now being one of the largest, if not the largest, of its kind—*i.e.*, a municipal station exclusively operated on liquid fuel—in either Great Britain or Ireland.

Fig. 2 is a front view of the new Vickers-Petters-Metropolitan-Vickers set, and a rear view of the same set is shown in fig. 3, the new G.E.C. motor generator being in the foreground of the latter illustration.

The water circulation of the new engine is effected by duplicate motor-driven Rees Roturbo pumps, the cooling being by means of a "Roy" open-type wood tower.

Fig. 6.—De Laval Oil Separator.

A similar set of motor-driven pumps has also been erected for the water circulation of the Mirrlees engines shown in fig. 1, and the piping of all four pumps

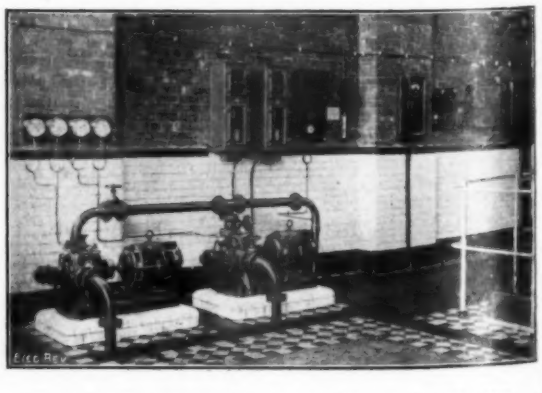

Fig. 7.—Pyrometer Indicator, Water Alarm, and Circulating Pumps.

is interconnected, so that in case of a breakdown the pumps can be interchanged or worked in combination on any of the three large engines.

Fig. 5 is a view of the three cooling towers, the exhaust outlets of the three small engines, and the 10-ton oil storage tank which was erected in 1912. The exhaust silencers of the three large engines are erected on the extreme far side of the engine-room wing shown in fig. 3, adjacent to the 500-ton oil storage tank.

A description of the plant would be incomplete without reference to such important details as the provision of numerous fire extinguishing appliances of various types to meet any emergency. The new engine is also equipped with electric pyrometers for measuring the temperature of the exhaust gases, and an automatic bell alarm to indicate defective running of the water-circulating pumps.

Fig. 6 is a general view of the "De Laval" oil separator* for treating dirty lubricating oil, and also shows a small mangle which is used for squeezing oil from waste rags. Fig. 7 is a view of the exhaust pyrometer indicator, water alarm, and the water-circulating pumps of the new engine.

The recent extensions, and also those of 1915, were carried out to plans and specifications prepared by the engineer and manager of the undertaking, Mr. Percy A. Spalding, A.M.I.E.E., A.M.Inst.C.E., who also supervised all details of the erection of the plant.

Like most other industries, the Dundalk electricity undertaking passed through very trying experiences and struggled hard against most abnormal conditions of working during the Great War, and also during the more domestic disturbances of the past two or three years—notwithstanding which the supply was kept going without any interruption, except on two occasions when (for short periods) the plant was shut down due to abnormal causes quite beyond the Council's control. However, a substantial net profit (over £700) has been earned during each of the past two financial years and, assuming that industrial conditions become more normal, it may confidently be anticipated that the undertaking will be a valuable asset to the municipal Council and an indispensable industry to the ratepayers. The Council has so far adopted a broad-minded policy as regards the undertaking, and a continuance of this policy will ensure the successful carrying on of the concern which has now had nearly £70,000 expended upon it.

As an illustration of the extent to which the public supply of electricity in Dundalk has developed, the following figures are abstracted from published statistics representing the output for the year ended March 31st, 1922, expressed as an average per head of the population:—Dundalk, 92.6; Londonderry, 75.2; Belfast, 42.7; Dublin City, 32.9; and Rathmines, 21.7, so that the output *per capita* at Dundalk is by far the largest of any city or town in all Ireland.

The urgent necessity for the recent extensions will be evident from the following table:—

Year ended March 31st.	Total kWh Sold.	Maximum Load, kW.	Plant Capacity, kW.
1913	175,979	149	300
1917	712,367	488	740
1920	1,000,075	641	740
1921	1,189,268	835	740
1922	1,319,690	728	740
1923	1,081,495	763	740

The output during the year ended March 31st, 1922, was nearly five times as much as it was in 1914, *i.e.*, eight years previously. Since the last extension of generating plant in 1917, the output has been increased by nearly 100 per cent.

The new extensions were officially inaugurated on September 27th in the presence of a distinguished gathering, the ceremony being followed by a pleasant social function.

* Elec. Rev., September 16th, 1921; p. 388.

RADIO NOTES.

China.—Broadcasting at Shanghai.—Several attempts have been made at Shanghai to establish radio broadcasting stations, the first being that of the Radio Corporation of China, whose equipment was operated for a short time. A little later the Electric Equipment Co. installed a 50-watt set, the station being used ostensibly for experimenting and for demonstrating radio sets to its customers, and is still in service. Broadcasting programmes were next offered by the *Evening News*, a local paper, and by the Wing-On Co., Ltd., a large department store, which recently installed a station, but the right of these to continue has been questioned by the Chinese Ministry of Communications. Development has been retarded by the fact that the importation of radio apparatus was prohibited by the Chinese Government on March 30th, 1923. This embargo was based upon the presidential mandate of April 18th, 1915, article 1, which stipulates that all "telgraphs and telephones, whether wire lines or wireless, are called electric communications," and article 11 thereof states that "electric communications shall be operated by the Government." The Shanghai Amateur Radio Society has been active in a propaganda way, but, *Commerce Reports* says, it is improbable that foreign manufacturers will ever again be able to compete successfully in this market.

Irish Free State.—Broadcasting.—Radio-telephony in Ireland is now free of military restriction. The position at present leaves the whole control as regards permits, licences, and supervision, in the hands of the Post Office authorities, who explain that at the moment no licences will be issued to private individuals pending the termination of the negotiations in progress with regard to the formation of a broadcasting company in Ireland.

Radio-Broadcasting.—In view of the statements which have recently appeared in the Press from the B.B.C. and from other quarters, the Committee of the Wireless Retailers' Association considers it desirable that one or two additional "facts" should be realised by the public: "The first is that the protection which has been given to British manufacturers is not protection in the accepted sense of the word, but the absolute prohibition of the use by the public of manufactures of overseas origin. However good the articles may be the public may not purchase them, even though prepared to pay an import duty. The second is that manufacturers have profited by the monopoly conditions created by the first agreement between the Postmaster-General and the B.B.C. to impose oppressive terms on retailers, the complaint from firms, both large and small, being that out of the ample profits made by manufacturers the small percentage allowed to retailers is insufficient to make their businesses pay. That the new agreement excluding imports is to be similarly utilised may be gathered from the fact that, following close on the statement of the Postmaster-General, comes the information that manufacturers purpose not only to reaffirm their present inadequate terms to retailers, but in some cases actually to reduce them. It is as a result of the monopoly that much of the disorganisation existing in the trade has occurred and the adoption of the recommendations of the Broadcasting Committee is, and will remain, an urgent need."

The British Broadcasting Co. has issued the following statement: "The B.B.C. is very gratified at the favourable reception which has been accorded to the proposals of the Postmaster-General with regard to the future of broadcasting by the Press, the listening public, and the trade. The B.B.C. is particularly glad to have the assurance of so many wireless firms that now the £50 deposit and other conditions of the original agreement have been modified they will be happy to throw in their lot with the B.B.C. There is evidently widespread satisfaction in the radio industry that the Postmaster-General's proposals with regard to the constructor's licence give promise of retaining the trade in the hands of British manufacturers.

"It is important to note that the only trade criticisms of the Postmaster-General's recommendations have come from one or two associations with high-sounding designations, which are interested in the sale of foreign apparatus. The only other criticism that has been made refers to the lack of one single licence, but unfortunately it was impossible to secure this and retain the trade in British hands."

Wave Length.—The British Broadcasting Co. is in negotiation with the Post Office with regard to the extension of the wave bands recommended by the Broadcasting Committee. The following lengths have been temporarily allotted: Aberdeen, 495 metres; Bournemouth (formerly 410), 385 metres; London, 363 metres; Manchester, 370 metres. The rest are unchanged.

Interim Licences.—The *Evening News* is officially informed that the Post Office has decided to extend the period during which radio interim licences can be obtained until October 31st. The original period ended on the 15th inst.

It is estimated that, roughly, the total number of 15s. licences sold up to midnight on the 13th inst., was 160,000, of which about 140,000 were interim and 20,000 constructor's licences. In addition, during the last ten days about 10,000 10s. licences have been sold.

It has been decided that, while the ordinary experimenter's 10s. licence does not permit the holder to use broadcast matter for any but strictly experimental purposes, the holder may be allowed to "listen-in" on payment of an extra 5s. This makes the experimenter's and constructor's licences both 15s., with the difference that whereas the former may use what materials and components he chooses, the latter may use only those of British manufacture.

Bournemouth Station.—The new station of the British Broadcasting Co. at Bournemouth was to be opened officially on the 17th inst., with a speech by Lord Burnham. The chairman of the company, Lord Gainford, will also speak, and these addresses were to be transmitted by land lines to all the broadcasting stations.—*The Times.*

Wireless "Research."—A Juvenile Complaint.—The following letter appeared recently in the *Daily Mail*:—

"Sir,—May I point out the unfairness of the new wireless regulations?

I myself, a boy of fourteen, have saved for months to make a wireless set, and now I have to find 15s. for a licence before October 15th.

How can England expect to benefit by any scientific discoveries if such a premium is put on research? She looks to the coming generation. By these unfair regulations she will become the butt of other nations. Surely something should be done for the less wealthy section of the population?"

No doubt such a letter should not be taken too seriously; but there is a danger lest, through the conceited claims of precocious amateurs to be regarded as exponents of "research," the word may be brought into disrepute. The listener who seeks to avoid payment for his wireless entertainment is on a par with the youngster who crawls under the tent of a travelling menagerie "to study natural history."

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Argentina.—Buenos Aires.—November 2nd. State Railways. Electrical material (specification 15.00 pesos, paper). The Department of Overseas Trade states that it has not received any further particulars.

Australia.—Sydney.—December 12th. New South Wales Government Railways and Tramways. Rotary converter sets.*

November 21st. 1,000-kW sub-station units.*

December 5th. Transformers.*

December 19th. Sub-station transformers.*

January 21st. City Council. H.p. split conductor feeder panels.*

November 1st. Postmaster-General's Department. Telephone apparatus and parts.*

Melbourne.—January 3rd. Victorian Electricity Commissioners. Aluminium steel-cored cable and accessories. (October 12th.)

December 15th. Four 1,000-kVA single-phase transformers and spares. (October 12th.)

Balby (Doncaster).—October 20th. Electric lighting installation, Parish Church. F. Pickering, 24, Tickhill Road, Doncaster.

Blackpool.—Electricity Department. H.p. and l.p. paper-insulated, lead-covered, and armoured cables. (October 5th.)

Cheadle and Gatley.—October 25th. Urban District Council. Gasfilled metal-filament lamps for street lighting. (See this issue.)

Dover.—November 12th. Electricity Department. About 8 miles e.h.p. 3-core paper-insulated cables. (October 12th.)

Glasgow.—October 29th. Parish Council and District Board of Control. Stores, including electrical fittings and lamps, for the various hospitals for six months. Forms, &c., from Inspector and Clerk, 266, George Street.

Liverpool.—November 12th. C. & A. Modes, Ltd. Installation of electric lighting at new premises in Church Street and Church and School Lanes. (See this issue.)

London.—Battersea.—November 1st. Electricity Department. Six e.h.p. feeder cubicles. (See this issue.)

Lambeth, S.E.—November 1st. Borough Council. Installation of electric lighting at the Coroner's Court and Mortuary, High Street, Lambeth. (See this issue.)

Manchester.—October 22nd. Waterworks Committee. 1¼ miles of l.p. paper-insulated, lead-covered, and steel-tape armoured cables, various sizes. Secretary, Waterworks Offices, Town Hall, Manchester.

New Zealand.—Wellington.—Public Works Department. November 20th. Portable testing instruments for Mangahao power plant.*

December 4th. Metering equipment.*

December 11th. Transformers for the Waikato power scheme. Outdoor- and indoor-type apparatus for the sub-station at Penrose, Auckland.*

Reading. — November 3rd. Corporation. Complete equipment of an air-compressing station at Manor Farm, Reading, consisting of e.h. and l.p. switchboards and motors, transformers, air compressors, piping, valves, cables, measuring apparatus, cooling tank, &c. (October 5th.)

Skipton. — October 22nd. Urban District Council. Wiring and fixing electric light fittings in Town Hall and offices. Mr. A. E. W. Aldridge, Council surveyor.

South Africa.—Johannesburg.—Municipal Council. November 1st. H.p. cubicles.*

November 19th. Transformers.*

Stoke-on-Trent.—November 14th. Electricity Department. E.h.p. and l.p. switchgear for transforming sub-station, Marsh Street. (October 5th.)

Taunton. — November 16th. Electricity Department. One 1,000-kW steam turbine geared to a 1,000-kVA single-phase alternator, with exciter, and a 250-kW d.c. generator, complete with condensing plant, &c. (See this issue.)

Wicklow.—October 22nd. Wicklow County Board of Health. Electric lighting installation at County Hospital. P. W. Sheenan, secretary, Board of Health, Rathdrum.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Bolton.—Tramways Committee. Accepted:—

Rollers and gearing to shutters at Bridgman Street and Carlton Street sheds.—W. F. S. Holt.

Electric lighting of shop premises in Knowsley Street.—James Morris.

Barrow-in-Furness.

Electric lighting work and equipment at Barrow Town Hall.—J. Johnson.

Cardiff.—Electricity Committee. Accepted:—

23,500 yd. of cable (£9,195) for the extension to Llanishen.—Enfield Cable Works, Ltd.

Chesterton.—Board of Guardians. Accepted:—

Electric lighting work at the Institution.—Everett & Son.

Dumfries.—Town Council. Accepted:—

Main switchboard at the electricity works (£1,190).—Metropolitan-Vickers Electrical Co., Ltd.

Glasgow.—The Corporation, as briefly announced here a fortnight ago, has just placed a repeat order with the Mirrlees Watson Co., Ltd., for two surface condensing plants to work in connection with two 15,000-kW turbo-alternators, to be supplied by Messrs. C. A. Parsons & Co., Ltd. The condensers are of 26,000 sq. ft. cooling surface, and designed so that one half may be kept working while the other half is open for cleaning and inspection. This makes four sets which the Mirrlees Watson Co. will have supplied for this power station.

Kokstad (Cape Province).—In connection with the electric lighting scheme, the following tenders have been accepted: Messrs. Reunert & Lenz (£5,337), for steam plant; Messrs. Siemens, Ltd. (£1,180), for battery. The cable tender, amounting to about £7,000, was settled three months ago.

Launceston.—Board of Guardians. Accepted:—

Installation of electric lighting (£96).—F. Chapman.

London.—London County Council.—Highways Committee. Alterations to l.p. cables in connection with the proposed supply of power for the Tooley Street lines by the Bermondsey Borough Council from the Spa Road power station:—

Enfield Cable Works, Ltd. (Recommended.)	**£2,776**
Western Electric Co., Ltd.	3,695
British Insulated & Helsby Cables, Ltd.	3,794
Siemens Bros. & Co., Ltd.	3,837
Pirelli-General Cable Works, Ltd.	3,894

Stepney.—Electricity Supply Committee. Accepted:—

½ ton solder (£208).—G. W. Neale, Ltd.

2½ tons sheet lead (£86).—T. & W. Farmiloe, Ltd.

50 tons pitch (£362).—Grindley & Co., Ltd.

1,000 rolls 1-in. white tape (£85).—J. N. Hardy & Sons, Ltd.

36 T/C disconnecting boxes (£80).—Universal Electrical Manufacturing Co., Ltd.

One electrically-driven 5-ton runway hoist for switchboard gallery at Limehouse (£285).—Middleton Bros.

Margate.—Town Council. Accepted:—

Centrifugal pump, with electric motor and automatic control gear (£530).—Pulsometer Engineering Co., Ltd.

Portsmouth.—Town Council. Accepted in connection with the extensions to the Havant and Emsworth district:—

Switchgear for six sub-stations (£6,960).—Johnson & Phillips, Ltd.

Six transformers (£237 each).—General Electric Co., Ltd.

750-kVA single-phase, oil-cooled transformer (£509).—British Electric Transformer Co., Ltd.

Russia.—The *Ost Express* says that the Russian Trade Mission in Berlin has concluded an agreement with two British concerns and one Czecho-Slovak firm regarding the restoration of the high-power stations at Nizhni Novgorod and Schatur. The order comprises turbine generators of 80,000 kW. boilers, &c. The contracting firms will receive 15 per cent. of the whole cost in advance, 10 per cent. at the time of delivery, and the remaining 75 per cent. in the course of five years, the last-named sum bearing interest equal to the London bank rate. It is expected that the power stations will be in operation in October next year. It is further planned to interest foreign capital in the erection of a power station at Kashira.—*Reuter's Trade Service* (Berlin).

A previous reference to Russian orders given to a group of English industrialists for Schatur and Kashira appeared in the ELECTRICAL REVIEW for October 5th, p 498.

Swansea.—Electricity Department. Accepted:—

Two coal conveyors for electricity station (£260 each), complete with electric motor.—C. H. Johnson & Sons, Ltd., Manchester.

Sunderland.—Corporation. Accepted:—

30-ton crane.—Herbert Morris & Co.

FORTHCOMING EVENTS.

Northampton Engineering College Engineering Society.—Monday, October 22nd. At the College, St. John Street, E.C. At 5.30 p.m. Paper on "Hydro-Electric Installations," by Mr. J. H. Ratcliff.

Institution of Electrical Engineers (South-Midland Centre).—Wednesday, October 24th. At the Grand Hotel, Birmingham. At 6.45 p.m. Chairman's (Mr. J. D. Morgan) address.

(Irish Centre).—Thursday, October 25th. At Dublin. Chairman's (Mr. R. N. Tweedy) address.

(North-Eastern Centre).—Monday, October 22nd. At Armstrong College, Newcastle-on-Tyne. At 7.30 p.m. Inaugural address by the Chairman, Mr. T. Carter.

Manchester Electro-Harmonic Society.—Friday, October 26th. At the Albion Hotel, Piccadilly, Manchester. At 7.30 p.m. Opening concert.

Junior Institution of Engineers.—Friday, October 26th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Crystals for Wireless Receptions," by Mr. A. V. Ballhatchet.

Birmingham and District Electric Club.—Friday, October 26th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Electric Motors in Service," by Mr. H. Joseph.

Physical Society of London.—Friday, October 26th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

REQUESTS for information must be accompanied by a stamped addressed envelope.

We should be glad if any reader could advise us of the name and address of the makers of :—

GEM vibrators.

NOTES.

Appointments Vacant.—Manager for the House-wiring Department (Rs. 500 per month) of the Rangoon Electric Tramway and Supply Department. Assistant engineer in the Mains Department for the Portsmouth Corporation Electricity Department. Meter repairer and tester for Aberdare U.D.C. Electricity and Tramways Department. Draughtsman (electrical) for the Royal Aircraft Establishment, South Farnborough. Probationary inspectors in the Engineer-in-Chief's Department of the General Post Office. (See our advertisement pages.)

Mercury Turbine at Hartford.—For the first time in electrical history power generated from heated mercury vapour has applied to commercial service when on September 7th the Hartford (Conn.) Electric Light Co. phased in the pioneer mercury-turbine with other turbines at the Hatch Point and South Meadow stations. About 600 kW is delivered to the busbars. The development is being made by the American General Electric Co., represented by Mr. W. L. R. Emmett, consulting engineer.—*Electrical World.*

Indian Contracts for British Firms.—We quote the following from yesterday's *Times* :—" We understand that the issue of £1,000,000 for the Tata Power Company which, as announced by Sir Montague Barlow, is to be guaranteed under the Trade Facilities Acts, is not likely to be made for about a fortnight, but contracts have already been placed for £750,000 of equipment with a number of British firms, including Lancender's Cable Co., the English Electric Co., the British Thomson-Houston Co., and the Mannesmann Tube Co., which is controlled by Baldwins. Further contracts with British manufacturers are to be placed at a later date."

The New Jetty at Fowey Harbour.—In the article appearing on p. 581 of this issue, the following corrections should be made :—Line 8 : The total outlay was nearly £250,000, inclusive of increased siding accommodation. Line 35, second column, for stern read stem.

Freemasonry.—The installation meeting of the Kelvin Lodge No. 3,736 will be held at Mark Masons' Hall on Friday, October 26th, at 5 p.m., when Mr. A. Forbes Dick is due to be installed as W.M. for the ensuing twelve months.

The annual Ladies' Festival of the Kelvin Lodge was held at the Connaught Rooms on Friday, October 5th, when the W.M., Mr. Philip C. Ebner, and Mrs. Ebner received and welcomed over 100 members of the Lodge, their wives and friends, and an enjoyable evening was spent. An excellent musical programme was provided by W. Bro. Ralph Norris, and each lady received as a gift a charming momento of the occasion, as well as a box of chocolates.

American Electric Furnace Activity.—It is encouraging to note from the *Electrical World* that electric furnaces are again resuming activities, and it is added that, in addition to new applications, new types of furnaces are being developed which will afford a still greater field for the use of electricity in the metal trades. Sweden is the only nation that has found it economical to produce pig iron directly from the ore in an electric furnace. Developments are occurring that may extend this use of electricity, however. One of these is the indirect smelting of the ore by using two reduction processes, the first using coke and the second using electricity; the other is in the direction of using high-grade iron ores and changing them directly to steel by means of the electric furnace.

A very important application of the electric furnace is in the production of ferro-alloys. Of the twenty-three alloys now in use all but two can be economically produced in the electric furnace.

But the most encouraging sign of a greater use of electric furnaces is in the melting and refining processes required to make steel or high-grade pig iron. There are thirty different types of electric furnace of this character in America, and the total number of installations in 1923 in the United States was 406. The most recent developments in this application lie in foundry processes. So-called "synthetic pig" can be made readily and economically in certain localities, and malleable-iron foundries are studying the suitability and economics of the electric furnace for their needs. Steel castings also are becoming increasingly popular, and offer a field for electric furnace applications.

The induction furnaces have proved their merits in the brass industry and are rapidly superseding all other types. In addition, many special furnace applications, annealing ovens, and electric welding equipment are being used more extensively in the metal trades.

Fortunately, many of the service problems were solved and adequate control equipment was developed during the slack period following the war. It now is generally true that furnace loads are desirable ones.

Electrical Trades Benevolent Institution.—The annual Festival will be held on Wednesday, November 14th, at the Trocadero Restaurant, London; Sir Phillip Nash, K.C.M.G., C.B., will preside. The price of single tickets will be £1 1s. (exclusive of wine), and for a lady and gentleman £1 11s. 6d.

Educational.—UNIVERSITY COLLEGE, UNIVERSITY OF LONDON. —The 1923-24 Calendar is a bulky volume (about 600 pp.) containing very full details of staff and curricula, with lists of graduates, students, &c., regulations and particulars of the social side of the institution.

Thames Tunnel Project.—The Lower Thames Tunnel having been scheduled among the works to relieve the unemployed, high hopes are entertained by the Executive Committee, of which Sir Alexander Richardson, M.P., is chairman, that it will be proceeded with at an early date. The objects of the tunnel are three-fold. First, to develop the industrial resources of Kent, and incidentally the eastern half of the South of England; secondly, to bring the North of England into direct relationship with the Channel ports; and thirdly, to relieve the congested condition of London traffic. Kent is likely to lose its character as the garden of England and the development of its coal and iron industries by Messrs. Dorman, Long & Co. is the beginning of an era of industrialism for Kent.

Mr. H. W. Towse is the originator of the tunnel scheme. The construction of the tunnel will bring with it the building of a new railway line from Dunstable to Tilbury, with an important centre at Brentwood. It is proposed to make this section electrical, and there are already facilities on the northern bank of the river for this purpose. The railway group into whose hands this work will fall will be the London and North-Eastern, which will secure running powers over the Southern Railway. This will necessitate the improvement of that line through Chatham to Dover and Folkestone.

Such a tunnel as that proposed would greatly relieve the congestion of London traffic, because it would obviate the handling of goods sent from north to south and *vice versâ*. It is designed to link up the whole of the Underground system of railways with the Southern Railway at Barking, and to provide electric trains, which would run from Gillingham or Faversham to any part of London without changing for the inner circle. There are also in existence plans for the construction of an outer circle electric railway round London at a distance of about 15 miles. This, it is estimated, would greatly relieve Metropolitan traffic.

Electrical Insulating Papers.—As the result of the experience gained since the publication of directions (Ref. A/S1) for the study of unvarnished insulating papers for purposes other than the manufacture of cables (the term "unvarnished" denotes that the paper has not been varnished or impregnated with insulating compounds, but embraces material that has been subjected to preparatory treatment during manufacture) the British Electrical and Allied Industries Research Association has found it desirable to modify several of the clauses and to add a test for absorption. This test, as is explained in a report (Ref. A/S5) in the September issue (Vol. 61, No. 322) of the I.E.E. *Journal*, is intended to indicate the ability of paper to absorb oil or varnish in a direction normal to the surface. The temperature at which specimens are conditioned has been altered to 20 deg. C.; and the clauses for the determination of thickness and density have been simplified. In order to avoid discrepancies in the results obtained in the porosity test, due to the variation of the air pressure, this test has been modified by ascertaining the time required for a constant volume (100 cm³) of water to flow out of the burette. The procedure for determining the acidity, alkalinity, and the amount of resinous material in the paper respectively has been improved, and a slight modification made in the test for nitrogenous material. The amount of paper to be employed in the mineral ash test has been reduced to 5 grammes.

In the first report on the subject (Ref. A/S1) three tests were inserted for detecting metallic particles with a view to gaining experience on the relative efficacy of the tests. It has been found that the old test (c) is the most satisfactory and the other two have therefore been deleted. It is now found that there is no necessity for a clause dealing with crinkling under tension. The method for determining the directions of the "length" and the "width" of paper suggested in the appendix to Ref. A/S1 was not applicable to thick papers, and another method has therefore been adopted which is suitable for all thicknesses of paper.

In the schedule the various purposes for which papers are employed have been reclassified with a view to the simplification of the tests that are applicable to papers for different uses. The schedule of papers employed for particular purposes has been deleted, as with improvements resulting from this research the schedule no longer represents the state of the art.

It is anticipated that in the near future the Association will be in a position to make recommendations to the British Engineering Standards Association for the issue of a purchasing specification for electrical insulating papers (unvarnished).

Scientific and Industrial Research.—The Imperial Economic Conference at a recent session set up a committee to inquire into the best method of pooling information concerning scientific and industrial research and of making it available Imperially. The appointment of the committee was agreed to after Lord Salisbury, Lord President of the Council, had made a statement with regard to the Department of Scientific and Industrial Research.—*The Times*.

Response of Plants to Artificial Light.—Amongst the papers that were read at the Convention of the American Illuminating Engineering Society in September last were two describing experiments in the stimulation of plant growth by artificial light. From the *Transactions* of the I.E.S. we learn that several thousand vegetable seedlings and a larger number of flowering plants started from cuttings were placed under ten 500-watt, 110-volt Mazda C clear lamps from March 1st, 1923, to April 4th, 1923. The lamps were lighted at 9 p.m. and automatically extinguished at 2 a.m. during a five weeks' test. In addition to the artificial light, the plants were exposed to sunlight. Check plants under sunlight only were duplicated in size and variety. As a result, the plants under artificial light grew more rapidly, and the flowering plants bloomed approximately eight days earlier than the check plants. The chemical tests showed approximately the same amount of chlorophyll in both groups of plants. In his paper, Prof. R. H. Harvey, of the University of Minnesota, who is carrying on the investigation, gave a progressive series of illustrations and curves showing the remarkable growth and production of forced plants. Light, one of the most important external factors in the growth of plants, may in a few years be supplied economically to the commercial grower which will mean that the crops, both vegetables and flowers, will be raised in a shorter period, that there will be earlier production in the spring and also gathering of the crops on scheduled dates.

Prof. Hugh Findlay showed in another paper that the optimum conditions of light intensity for the growth of a great variety of plants had been determined, using continuous artificial light. The intensity requirements of many plants is such that growth in artificial light alone is practicable in northern regions where winter sunlight is scarce and unreliable. Plants, such as Easter lilies, can be speeded up in time of blooming to bring them into the market at a certain date. The use of artificial light makes it possible to force the blooming of two varieties at the same time so that hybrids may be more easily produced. There is a correlation between the intensity of continuous illumination and the quantity and nature of the carbohydrates produced in photo-synthesis. The production of male or female flowers by some dioecious plants is dependent upon light intensity. This paper is a result of investigation conducted at Columbia University and should be extremely interesting to laymen as well as to the illuminating engineer.

Violets in July, poinsettias in August, midwinter iris, dahlias in May, radishes that do not seed, cosmos fifteen feet tall, and other similar results are being produced by the United States Bureau of Plant Industry as a result of recent experiments and discoveries of the laws of plant growth according to Mr. L. E. Theiss in *World's Work*. Plants bloom and fruit solely in response to the length of daylight occurring at their normal seasons of maturity, and by using electric light to increase the number of light-hours until they correspond with the number of hours of sunlight at the season of a given plant's time of blooming, the plant will bring forth blossoms, regardless of the time of year Conversely, if the long days of midsummer are made shorter by putting the plant in a dark place after a given number of hours of daylight, the plant will bloom out of season if its normal time of blossoming is one of natural short days. Working with this knowledge the Bureau has caused plants to blossom at all seasons of the year; advanced and retarded the fruition of vegetables, and by synchronising the blooming-times of flowers and plants that normally bloom months apart, opened a new field for cross-breeding and development of hitherto unknown species. The value of these discoveries lies in the future, according to Mr. Theiss, who cites experiments with tobacco as showing their commercial importance. "Maryland Mammoth tobacco seedlings grown in hot-houses in Maryland, where the winter days are short, flower when they are no larger than other tobacco plants. Artificial lengthening of the daylight hours produced plants that reached the desired mammoth proportions before seeding, and further experiments showed that if the plants were grown in Florida in winter, the light periods and climate were favourable both for growth and seed production. In other words, electric light showed the way for cheap and abundant Florida-grown seed. "New crops, new things to eat, that are now non-existent and even undreamed of, will as assuredly come as daylight follows dawn," writes Mr. Theiss. "Things we can hardly even imagine will come from these discoveries of why plants flower and produce fruit."

A "Wireless" Insurance Policy.—The Liverpool Marine and General Insurance Co., Ltd., became the pioneer of radio insurance when it introduced a full and comprehensive policy covering owners in respect of their apparatus itself and third party risks which arise out of the use of the set. The special policy was noticed in our issue of November 11th, 1921, p. 795.

It has been found that a demand exists for some form of protection for landlords who wish to be compensated for damage done to their property by the fixing and using of a wireless set and aerials. In many cases landlords are withholding their consent to these erections without some legal form of indemnity or obligation being given, and to meet this difficulty the company has prepared a special landlord's wireless protection policy. The advantages of the scheme from the tenant's point of view are that it relieves him entirely of all legal obligations to his landlord in respect of his set, and yet enables him to indulge in his hobby without interference. To the landlord it gives all the protection necessary for him in the event of any loss sustained from the fixing or using of the set, and it has the additional advantage that the landlord has the knowledge that any damage done is made good by the insurance company, and that he need not look to the tenant for reinstatement.

INSTITUTION NOTES.

Institution of Electrical Engineers.—The following is a list of the informal meetings that are to be held during the coming session on Mondays at 7 p.m.:—

November 5th.—Discussion on "Engineering Training." Opened by Dr. A. Russell, M.A., D.Sc., president.

November 19th.—Discussion on "Power in Telephone Exchanges." Opened by Mr. A. B. Eason.

December 3rd.—Discussion on "Electrical Apparatus for the Dairy." Opened by Mr. C. M. R. Balbi.

December 17th.—Discussion on "Students in Electricity Undertakings."

January 7th.—Discussion on "Troubles Experienced with Domestic Electrical Appliances." Opened by Mr. J. W. Beauchamp.

January 21st.—Discussion on "Broadcasting." Opened by Mr. E. H. Shaughnessy, O.B.E.

February 4th.—Discussion on "Storage Battery Troubles." Opened by Mr. F. W. Crawter.

February 18th.—Subject to be announced later.

February 25th.—Smoking concert. At the Engineers' Club.

March 3rd, March 17th, March 31st, April 14th.—Subjects to be announced later.

WESTERN CENTRE.—A large and representative gathering of South Wales engineers attended the opening meeting of the 1923-24 session of the Centre at Cardiff on Monday last. Mr. F. Tremain presided, and introduced the new chairman, Mr. C. T. Allan, A.M.I.E.E., who, in delivering his inaugural address, referred to the training of young engineers, remark-

that he thought the fetish of manual training was often erdone, because the present-day machine and mass-produc-n methods might often leave the apprentice with little owledge beyond that of operating one or two machines. the coming commercial war they must be already in their ile when it arrived by preparing the brains of those who re to succeed the young fellows who gave their lives for ir country. He believed that this advanced training should within the reach of all, even free of cost, if possible. If e commercial side were added to the training of an engi-er, they might see engineers at the head of more industries. alling with the present status of the already qualified engi-er, Mr. Allan pointed out that in the endeavour to disso-ate themselves from all suggestion of advertising, was it not ssible to go a little too far in the other direction? The ture of the British engineer to appreciate publicity had ve disadvantages. He hoped the engineer of the imme-ate future would see his opportunity and assume his natural ht to direct as well as to construct.

Mr. Hubert Spence-Thomas, Major David, Mr. Burr, Prof. eon, Prof. Knox, Mr. D. Cleever, and several other mem-rs took part in the discussion.

North-East Coast Institution of Engineers and Ship-uilders.—The annual general meeting of the Institution is ing held to-day, when, after the presentation of the Coun-il's report, a paper by Guy Bengough, D.Sc., R. May, B.S.M., and Ruth Pirret, B.Sc., on "Corrosion of Con-ser Tubes" will be read. The report reviews the papers sented during the 1922-23 session and announces that the stitution's gold medal has been awarded to Mr. T. Grime his paper on locomotives. A total membership of 1,502 recorded.

Institution of Heating and Ventilating Engineers.—The que system of ventilating the L.C.C. Council Chamber s described by Messrs. P. M. B. Grenville and T. Moodie, I.Mech.E., at a meeting of the Institution on October 9th a paper entitled "The London County Hall Plant, Facts, gures and Reflections." The plant is capable of delivering 00 cu. ft. of air per hour for every occupant of the chamber. he apparatus consists of a humidifier, heating batteries, auto-atically controlled from the chamber itself, fans and ice nks for cooling.

Institute of Transport.—The Institute has published nibuses and regulations of the examinations which are to e a necessary preliminary to becoming a graduate or asso-ate member after October 1st, 1925. Transportation is turally the chief constituent of the tests; this is viewed om a number of angles—technical, economical, and com-ercial. The other subjects include languages, geography, thematics, &c., and have a very wide range. On Tuesday st Mr. Philip Burtt, a member of the Council, delivered ecture upon the examination scheme, in which he showed he necessity of this to maintain the standing of the Institu-on and confer an added value upon membership.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

On October 8th a large number of the directors d employés of the firm of Ed. Bennis & Co., Ltd., thered at a dinner at Parker's Hotel, Manchester, to bid ewell to Mrs. EDWARD BENNIS upon her departure for New aland. Mr. Ainsworth, secretary and director, occupied the air, and Mr. Lane—the oldest employé present—handed to rs. Bennis an album containing the photographs and details the careers of those employés who were associated with her e husband, the founder of the firm.

Miss GRACE C. DOW, chief clerk of the Greenock Corpora-on Electricity Department, was presented with candelabra, ndlesticks and a silver-backed mirror, on October 12th, by e chief engineer and manager of the department on behalf f the staff and employés, and members and officials of the rporation, on the occasion of her leaving the service of the partment. Miss Dow is to be married to Mr. J. A. BERTSON, consulting engineer, Manchester (formerly chief ectrical engineer at Greenock and at Salford) at Greenock October 30th.

Professor P. C. LEA, D.Sc. (London), has been appointed to e Chair of Mechanical Engineering at Sheffield University. e is at present Professor of Civil Engineering at Birming-am University, and at Sheffield will succeed Dr. Ripper as ead of the Engineering Department of the University.

Stepney Borough Council General Purposes, Staff and Edu-ation Committee, on the recommendation of the Electricity ommittee, recommends the Council to make an annual pay-ent of £100 and £25 respectively out of the funds of the ectricity supply undertaking, to Mr. B. J. BELSHER, the borough engineer and surveyor, and Mr. B. W. STUTTLE, the principal engineering assistant, in recognition of the duties and services rendered by them to the undertaking.

At Loughborough, on Tuesday last, Mr. E. G. PHILLIPS read a paper on the pneumatic handling of coal and heavy materials at the first meeting of the East Midland Sub-Centre of the I.E.E., of which he is chairman for the 1923-24 session. He is a consulting electrical and mechanical engineer in practice at Nottingham. He was born in 1880, and after his electrical engineering education became an apprentice to the L.B. & S.C. Railway under Mr. E. J. Houghton. Electricity

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MR. E. G. PHILLIPS, M.I.E.E.,
Chairman of the East Midlands Sub-Centre of the I.E.E.

supply work claimed his attention in the mains departments of the City of London Electric Lighting Co., Ltd., and the County of London Co., and after an engagement with Messrs. Vickers, Son, & Maxim he became chief electrical engineer to Messrs. Burroughs, Welcome & Co., Dartford, Boots Pure Drug Co., Nottingham, and five allied companies. For the concerns just mentioned he was responsible for the entire electrification of their factories and for the design and erection of a large power station. Mr. Phillips was for several years chairman of the Nottingham branch of the Electrical Contractors' Association, N.E.C.T.A., and the National Federated Electrical Association. He has been prominently connected with the Nottingham Society of Engineers, is a member of the I.E.E., and an associate member of the Institution of Mechanical Engineers.

Mr. S. F. BLYTH has been appointed electrical engineer, *pro tem.*, by the Yarmouth Town Council. A deputation of councillors is to visit towns where one engineer controls both the electricity supply and the tramway systems before coming to a final decision regarding the Yarmouth appointment.

The business of East Anglian Electricity, Ltd., which was started in 1896, when its sales for the year amounted to £115 17s. in one town, has made great strides, until the sales for last year reached £33,243 in eight towns. We have referred already to recent developments in connection with the company. It was obvious that further management was needed, and Mr. NAPIER PRENTICE, the managing director, secured the services of Mr. C. P. DAWES as secretary. Mr. A. HUGH SEABROOK, M.I.E.E., of Sir Charles Bright & Partners, has now been appointed consulting engineer, and Mr. B. G. DRUMMOND, A.M.I.E.E., general manager. Mr. S. F. HAWLEY EDWARDS has joined the board of directors as financial adviser, and Lieut.-Col. H. W. WOODALL, C.I.E., has accepted the chairmanship vacated by Mr. Peddar (after 25 years' service) last year. With this reconstituted direction and management Mr. Prentice is expecting another forward movement in electrical developments in East Anglia.

Dr. B. HODGSON, O.B.E., M.Sc., Ph.D., F.Inst.P., late of H.M. Signal Experimental Establishment, is now engaged in the research laboratory of the Mullard Radio Valve Co., Ltd.

Mr. THOMAS CARTER, M.Inst.C.E., M.I.E.E., Fel.A.I.E.E., the new chairman of the North-Eastern Centre of the Institution of Electrical Engineers, will deliver his inaugural address

for the session on Monday, October 22nd. Mr. Carter, who was born at Berwick-on-Tweed in 1877, was a student at Heriot Watt College from 1893-1895, gaining many first prizes and medals and the diploma of the college in electrical engineering. He was a pupil-apprentice with Messrs. J. H. Holmes & Co. from 1895-1898, and he afterwards worked in that firm's drawing and design office for a year. In 1899 he was awarded the Heriot-Watt travelling scholarship, then newly established, and went for one year to the Königliche Technische Hochschule in Hanover, travelling during holidays in Germany and Switzerland, so as to get practical information about electrical developments. He returned to this country in 1900, and on the invitation of Principal F. Grant Ogilvie, of Heriot-Watt College, became demonstrator and assistant lecturer in the electrical department there, under Professor F. G. Baily. In May, 1901, he returned to Messrs. J. H. Holmes & Co. as chief electrician, supervising their test department and dealing with technical matters in general. In 1906 he became their chief designer of direct-current machines, and continued so till 1918, dealing meantime more and more intimately also with general technical problems. In 1918 he became their chief engineer, a post which he still holds.

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MR. THOMAS CARTER, M.Inst.C.E., M.I.E.E.,
Chairman of the North-Eastern Centre of the I.E.E.

Mr. Carter was elected a student of the Institution of Civil Engineers in 1895, and a member in 1918. He became an associate of the Institution of Electrical Engineers in 1902 and a member in 1918. He was elected a fellow of the American Institution of Electrical Engineers in 1920. For some years past he has served on the Committee of the North-Eastern Centre of the I.E.E., over which he now presides. He has taken a special interest in the work of the Rules and By-laws Sub-Committee of the Centre, which has just completed a final draft of bye-laws for the Centre and for the Tees-side Sub-Centre, and of rules for the Students' Section of the Centre. He has contributed various articles to the technical Press.

Obituary.—SIR E. NUTTALL.—We regret to learn that Sir Edmund Nuttall, head of the firm of Edmund Nuttall, Sons and Co., Ltd., civil engineers and contractors, of Trafford Park, who are contractors for the building of the Barton power station of the Manchester Corporation, passed away suddenly on October 11th at the age of 53 years.

Mr. J. Y. BOWMAN.—The death took place, on October 7th, at the age of 49 years, of Mr. James Young Bowman, who for the past 11 years had been electrical engineer to Pease and Partners, at Esh Colliery, County Durham. Previously he was in the electrical department of Armstrong, Whitworth and Co.

Mr. J. M. WILLIAMS.—The death has occurred, at Rhyl, of Mr. J. Meredith Williams, for several years past inspector of the electricity department of the G.P.O., London. Mr. Williams was a pupil of the Rhyl Electricity Department.

Dr. J. A. HARKER.—It was our sad duty last week to record the death of Dr. John Allen Harker, O.B.E., D.Sc., F.R.S., on October 10th, at the age of 53. Dr. Harker was a member of the staff of the National Physical Laboratory for 16 years, being deputy to the director for the last eight years; from 1916 1921 he was director of research to the Ministry of Munitio and a member of the Nitrogen Products Committee, and served on a large number of Government committees dur the war. In 1922, Dr. Harker became a partner in the f of Messrs. J. F. Crowley & Partners, consulting engine and was engaged in reporting on, and carrying out exp mental work in connection with, electro-chemical processes various countries, particularly in connection with nitrog fixation. He was elected a Fellow of the Royal Society 1910, was a vice-president of the Faraday Society, and me ber of Council of the Physical Society of London.

NEW COMPANIES REGISTERED.

Scottish Lamps, Ltd. (12,852).—Private company. Reg tered in Edinburgh October 4th. Capital, £100 in £1 shares. To carry the business of engineers, electricians, constructors, dealers in motors, The first directors are:—J. C. Rennie, 4, Jane Street, Glasgow, grocer; J. Ogilvy, 1027, Sauchiehall Street, Glasgow, engineer. Qualification, one sh Secretary: J. C. Rennie. Registered office: 4, Jane Street, Glasgow.

Viennese Electric Lamp Works, Ltd. (192,913).—Priva company. Registered October 5th. Capital, £1,000 in £1 shares. To ca on the business as indicated by the title and that of electrical engine manufacturers of all accessories used in connection therewith, &c. The fi directors are:—C. Spiro, 198, Mare Street, Hackney, waterproof manufactur Rose E. B. Sweatman, 6, Weston Place, Well Street, Hackney, E., co mercial traveller. Registered office: 87 and 88, Charterhouse Chambe Charterhouse Square, E.C.

Radio-Acoustics, Ltd. (192,884). — Private compan Registered October 4th. Capital £10,000 in £1 shares. To carry on t business of electricians, electrical engineers and contractors, suppliers of el tricity, telegraphists, telephonists, manufacturers of, and dealers in wire apparatus, &c. The first directors are:—F. H. Burgess, 69, Braxted Pa Streatham Common, S.W.16, advertising consultant (chairman); A. T Sharman, 1, Morella Road, Wandsworth Common, S.W., electrical engine W. J. Ricketts, 32, Torrens Road, Brixton, S.W., electrical engineer. Qual cation, £300. Remuneration (except managing director) as fixed by t company. Secretary: C. W. Nadal. Registered office: 175a, Peckham Ry Road, S.E.

E. Goldston, Ltd. (193,027).—Private company. Reg tered October 11th. Capital, £2,500 in 2,250 10 per cent. non-cumulati preferred ordinary shares of £1 and 5,000 founders' shares of 1s. To ta over the business of an electrical engineer, &c., carried on by E. Goldst at 52, Marefair, Northampton, and to carry on the same and the busin of manufacturers of electrical apparatus, wireless fittings, &c. The fi directors are:—E. Goldston, 6, The Drive, Golder's Green, N.W.11, electri engineer (permanent); H. A. Garrett, 21, Bostock Avenue, Northampton, el trical engineer. Qualification: £300. Secretary: R. J. Spence. Solicitor: Prag, Gray's Inn Chambers, 20, High Holborn, W.C.1.

Stelling, Marsden & Clark, Ltd. (192,985).—Private com pany. Registered October 9th. Capital, £2,100 in 2,000 shares of £1 ea and 2,000 shares of 1s. each. To carry on the business of consulting ind trial engineers formerly carried on by A. R. Stelling, J. F. Marsden, an W. F. Clark as "Robert Stelling & Co.," at 88-90, Chancery Lane, W.C The first directors are:—A. R. Stelling, 101, St. George's Park Road, We cliff-on-Sea; J. F. Marsden (managing director), The Grenville Hotel, Grenville Place, South Kensington; W. F. Clark, 76, Comeragh Ro West Kensington, W.14 (all permanent, subject to holding 250 shares ea Qualification of ordinary directors, 50 shares. Remuneration of permane directors (A. R. Stelling and J. F. Marsden), £720 each per annum, W. F. Clark, £500 per annum. Secretary: W. F. Clark. Registered offic 88-90, Chancery Lane, W.C.2.

Wallingford and District Electric Supply Co., Ltd (192,961).—Registered October 8th. Capital, £13,000 in £1 shares. To ad an agreement with Edmundson's Electricity Corporation, Ltd., and generate and supply electricity in or near Wallingford, Clapcot, Bens Crowmarsh, and elsewhere in the counties of Berkshire and Oxfordshi The first directors are:—E. D. Webb, Gaston Manor, Tisbury, Wilts (ch man, Tisbury Electric Supply Co.); W. J. Wilder, High Street, Wallingf engineer; R. J. Wilder, "St. Luciens," Wallingford, engineer; F. J. Kir "The Lawn," Speen Hill, Newbury, mill owner; A. N. Rye, M.I.E.E., 6, Eaton House, Belsize Park Gardens, N.W., electrical engineer; W. Brandreth, A.M.I.E.E., Broad Sanctuary Chambers, Westminster, electri engineer. Minimum cash subscription, £10,000. Qualification, £300. Re muneration as fixed by the company. Secretary: F. R. Hedges. Registere office: 16, Market Place, Wallingford, Berks.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Burford Electric Light and Power Co., Ltd.—Mortgage dated September 26th, 1923, to secure £270, charged on land at Burf Oxon., with Burford Mills, &c., thereon. Holders: H. T. Birks and R. H Langley, both of 4, Bedford Row, W.C.1. Also second mortgage dated Se tember 17th, 1923, to secure £1,000, charged on the company's undertak and property, present and future, including uncalled capital. Holders: M A. B. Nalder, Layham House, near Hadleigh, Suffolk; and T. S. Cur 4, Bedford Row, W.C.1.

Welco Patents, Ltd.—Debenture dated September 20t 1923, to secure £60, charged on the company's undertaking and proper present and future, including uncalled capital (if any). Holder: H. J. Fis 55, Cartland Road, Hazlewell, Birmingham.

Carmarthen Electric Supply Co., Ltd.—Satisfaction i full on July 18th, 1923, of mortgage dated March 26th, 1921, securing £1,00

St. Helens Cable and Rubber Co., Ltd. (87,774).—Re turn dated May 22nd, 1923. Capital, £100,000 in £1 shares. £1,000 sh taken up. £84,000 paid. Mortgages and charges, nil.

Union Cable Co., Ltd. (67,054).—Return dated Ma 24th, 1923. Capital, £100,000 in £1 shares. All shares taken up. £1 p share called up on 50,000 and 10s. per share on 50,000 shares. £75,000 pai Mortgages and charges, nil.

South American Light and Power Co., Ltd. (74,446).— Return dated August 8th, 1923. Capital, £200,000 in £1 shares. 180,00 shares taken up. £130,007 paid. £49,993 considered as paid. Mortgages an charges, £126,000.

Newquay Electric Light and Power Co., Ltd. (85,451).—Return dated January 11th (filed May 7th), 1923. Capital, £15,000 in £1 shares. 13,124 shares taken up. £2,944 paid. £10,180 considered as paid. Mortgages and charges, £15,500.

Walter's Electrical Manufacturing Co., Ltd. (94,300).—Return dated September 14th, 1923. Capital, £18,000 in £1 shares. 16,875 shares taken up. £6,875 paid. 10,000 considered as paid. Mortgages and charges, nil.

CITY NOTES.

The Oerlikon Company.—The report of the Maschinenfabrik Oerlikon, of Oerlikon, Switzerland, refers to the difficulties which this company experienced in 1922-23 through the effects of foreign competition in Switzerland, which was facilitated by depreciated currency and the import duties. The slightly better course of business owing mainly to the electrification of the railways has now abated. After having made provision for depreciation the accounts show net profits of 1,830,000 fr., as compared with 1,810,000 fr. in 1921-22, and the dividend at 8 per cent. is the same rate as in the preceding year.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be officially quoted :—

Cawnpore Electric Supply Corporation.—£250,000 5 per cent. debentures (free of income tax).

Midland Counties Electric Supply Co.—750,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 750,000.

Power Securities Corporation.—500,000 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 1 to 500,000.

Dumbarton Burgh and County Tramways Co.—The *Financier* states that for the year ended July 31st there was a profit of £3,237, including the amount brought in. An instalment of £2,428 is appropriated to debenture sinking fund, leaving £809 to carry forward.

Victoria Falls and Transvaal Power Co., Ltd.—The net earnings, including those of the Rand Mines Power Supply Co., Ltd., for the quarter ended June 30th amounted to £239,372 before providing for British and South African taxation.

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended September 30th of 15s. per cent. on the ordinary shares, less tax.

Electrical Utilities Corporation, Ltd.—Dividend of 1¼ per cent. on the preferred stock for the quarter ended September 30th.

United River Plate Telephone Co., Ltd.—Interim dividend of 3 per cent. on the ordinary shares, free of tax.

Callender's Cable and Construction Co., Ltd.—Interim dividend of 5 per cent., less tax, on the ordinary shares.

Montreal Light, Heat and Power Companies.—The Montreal Light, Heat and Power Co. has declared the usual quarterly dividend of 8 per cent. per annum; and the Consolidated Co. the usual quarterly dividend of 6 per cent. per annum.

United Electric Tramways of Caracas, Ltd.—Dividend 10 per cent. for the year, less tax. The net revenue was £22,792, plus £8,503 brought forward. £14,294 is to be carried forward, subject to Corporation Profits Tax.

Indo-European Telegraph Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum, free of tax.

Brazilian Traction, Light and Power Co., Ltd.—Quarterly dividend of 1 per cent. on the ordinary capital stock.

STOCKS AND SHARES.

Tuesday Evening.

The great difficulty is to obtain investments for people who want to use money that, were industry more active, would certainly be going into trade channels. There seems to be little indication, however, of that revival in business which everyone would like to see. The Chancellor of the Exchequer holds out no hope of relief in taxation in the next Budget, and this in itself is not encouraging to trade circles. It looks as though money must be compelled to flow, for some time, into Stock Exchange securities for lack of profitable avenues of employment elsewhere. Hence the War Loan is up to 103, and one of the Crown Colonies has this week issued a loan, the yield upon which is no more than £4 11s. per cent. on the money, or 3¼ per cent. net, allowing for income tax at 4s. 6d. in the £.

It might also have been thought that, if trade was going to remain dull, people would leave off buying industrial shares, not only the ordinary issues but preference as well. The contrary is the case. Although a good many industrials of the more or less sketchy order are heavy in price, the really good shares are in constant demand. Debentures and preferences are more difficult than ever to get by those who look for a safe 5½ to 6 per cent. on their money. In the catalogue of electricity shares, for instance, the feature is the way in which supply is continually narrowing. County of Londons are easier on the week at 2 1/16, and Charing Cross at 12⅝, but in all the other cases the strength of the market remains unabated.

Bromptons are up 1/16, Kensingtons 5s., St. James' preference ⅛—at 6¼. Londons are again ⅛ up at £5 per share, at which price the yield on the money comes to barely 6 per cent. There may be, however, room for further improvement in these shares. Metropolitans strengthened to 35s., City of Londons to 31s. 3d. Outside the London group, Bournemouths are steady at 37s. 6d., Bromley (Kent) at 28s. 6d. Cawnpore Electric ordinary improved to 24s. Folkestones last changed hands at 90s. in the middle of August, but the price is higher now. Lancashire Electric ordinary at 25s., and the new ordinary at 1s. 7½d. premium, are both better, the new preference being strong at 1s. 6d. premium. Llanelly ordinary attract a little attention in the neighbourhood of 20s., and the 6 per cent. preference stand at their par value of £1. Madras ordinary at 24s., and Calcuttas at 32s. 6d. are better. The new Tokio debentures are a dullish market at 86½. Victoria Falls ordinary further advanced to 30s. 6d., the preference remaining at about 28s. 3d. Whitehall Electric 6 per cent. debenture shows a good deal of activity around 96 middle. Yorkshire Electric ordinary changed hand at 27s. on Monday, and the 6 per cent. preference were done up to 23s. 3d.

Mexican Utilities are a heavy and lumpish market. Mexican Light and Power common shares have fallen 4, and the preferred 2, to 24 and 53½ respectively. The Tramway Co.'s bonds have not altered. London United Tramway 4 per cent. debenture eased off to 60. London and Suburban preference remain heavy at 9s., a little uneasiness having been aroused by the probable effect upon the company's traffics that the incursion of pirate 'bus competition may have had during the summer months. Anglo-Argentine Tramways 5 per cent. debenture is better, and Brazilian Tractions hardened to 47.

The cable group is good, with Globes 5s. higher and Westerns an eighth up at 17¼. Anglo-American preferred strengthened to 103. Marconis gave way to 2¼ at one time, but rallied to 2 5/16. With the winter drawing on, it is assumed that the broadcasting branch of the company's business will once more become popular, and the attention drawn to the matter by the Postmaster-General's decision with regard to licences is expected to give fillip to wireless in the home. It is hoped, moreover, that the Colonial Conference now being held in London may have the effect of hastening the Government's decision with regard to the amount of compensation payable to the Marconi Co. in respect of war service, a decision which, presumably, it will be necessary for the company to know before it can embark upon the fresh schemes of extension which await development.

The Underground Railway issues present a particularly firm front. Metropolitans have risen to 78, and Districts are being steadily bought by people who look for a rise in the price to the neighbourhood of 60. Underground £10 shares jumped to 3⅜, the 1s. "A" shares to 10s. 9d., while the Income Bonds have surmounted 100. Nor is there much stock available of the prior-charge securities in this group, so it may be useful to instance a few of the stocks offered at the moment in this section. There is £2,000 City & South London 4 per cent. debenture, interest April and October, to be obtained at 83½, giving a yield of £4 17s. 6d. per cent. A modest amount of District 4 per cent guaranteed at 79½ can be obtained to yield £5 1s 6d. on the money. East London 4 per cent. "B" debenture at 70½ pays £5 14s., and there is £5,000 of the company's "A" debenture in the market at 82¼, returning £4 17s. 9d. per cent. More substantial amounts of Metropolitan District and London Electric Power House 4 per cent. debenture stock can be bought at 83, free of stamp and fee, the return at this price being £4 17s. 6d. per cent on the money, interest in June and December.

In the manufacturing list, Metropolitan-Vickers put on ¼ at 2⅝. Electric Constructions are 30s. having gained a small fraction, and Henleys, at 48s., are better. Cromptons fell to 10s. Preference shares in this market are keeping their high prices. Babcock & Wilcox remain unchanged at 45s., though the market for this class of shares is inclined to be reactionary. Some people think that the Government's scheme for dealing with the unemployment problem will bring work to iron, steel and kindred companies. Rubber shares lean to the lower side, in consequence of the disappointment felt with the manner in which stocks of the produce continue to pile up in this country. Evidently the expected American buyers are in no hurry to fill their factories for the benefit of British rubber producers.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price Oct. 16, 1923.	Rise or fall.	Yield p.c.
	£					
Brompton Ordinary	1	12	12	2½	+ ⅛	£5 13 0
Charing Cross Ordinary	5	9	14	12¼	— ¼	5 7 8
do. do. do. 4½ Pref.	5	4½	4½	4¼	—	5 6 9
Chelsea	1	6	10	38/-	—	5 5 3
City of London	1	14	15	2⅛	+ ⅛	5 17 0
do. do. 6 % Pref. ...	1	6	6	24/-	—	5 4 4
County of London	1	8	10	2⅛	— ⅛	4 16 10
do. do. 6 % Pref. ...	1	6	6	23/8	—	5 3 3
Edmundson's Ordinary ...	3	Nil	7	3½	+ ⅛	5 12 0
do. 6 % Pref	6	12/-	6	6	—	6 0 0
Kensington Ordinary	5	10	12	10½	+ ½	5 18 5
London Electric	3	4	10	5	+ ⅛	5 19 9
do. do. 6 % Pref. ...	6	6	6	5¼	—	5 11 7
Metropolitan	1	7	8½	1⅝	+ ⅛	4 17 2
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	16/3	−9d.	3 1 6
do. 5 % Pref. ...	1	5	5	15/9	—	6 7 0
do. 7 % Pref. ...	1	7	7	23/-	—	6 1 9
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	16/3	+ ⅛	Nil
do. 5 % Pref. ...	1	2½	5	7	—	6 17 0
James' and Pall Mall ...	5	12	14½	11¾	—	6 3 5
South London	1	7	10	1⅝	—	5 8 3
South Metropolitan Pref- ...	1	7	7	24/6	—	5 14 8
Westminster Ordinary	5	10	12	10½	—	5 17 1
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	1	—	7 10 0

Home Rails.

Central London Ord. Assented	Stock	4	4	73	—	5 9 7
Metropolitan	,,	2½	3½	78	+ ½	4 9 9
do. District	,,	1	3	57	+ ½	5 9 1
Underground Electric Ordinary	10	Nil	Nil	3⅝	+ ⅛	Nil
do. do. "A" ...	1	Nil	Nil	10/6	+3d.	Nil
do. do. Income	Bonds	4	5	101	+2	*4 19 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	109	+ ½	5 16 6
do. Def.	,,	1½	34/6	23	—	6 9 0
Chile Telephone	5	6	6	6	—	5 0 0
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension	10	10	10	17½	—	5 14 0
Eastern Tel. Ord.	Stock	10	10	175½	—	5 14 0
Globe Tel. and T. Ord.	10	10	10	17⅝	+ ⅛	5 12 0
do. do. Pref. ...	10	6	6	11¼	—	5 7 7
Great Northern Tel.	10	24	22	27½	—	8 0 0
Indo-European	25	10	7	32½	—	5 7 8
Marconi	1	25	15	2⅞	—	6 9 10
Oriental Telephone Ord. ...	1	12	12	1½	—	*6 8 9
United R. Plate Tel.	5	8	8	7	+ ⅛	*5 14 4
West India and Panama ...	10	Nil	Nil	1/6	—	Nil
Western Telegraph	10	10	10	17½	+ ⅛	*5 14 3

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	21⅛	—	9 7 2
do. do. 2nd Pref.	5	Nil	5½	2⅛	—	11 17 10
do. do. 5% Deb.	Stock	5	5	79½	+1	6 10 9
British Electric Traction Ord.	,,	4½	5	74½	—	6 14 1
do. do. 6% Pref.	,,	6	6	101½	—	5 18 3
Brazil Tractions	100	Nil	4	47	+ ⅛	8 10 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	97½	—	5 14 3
do. do. Preferred	,,	5	96/-	83	−1	*5 13 3
do. do. Deferred	,,	3	127/-	97½	—	*6 10 0
do. do. Deb. ...	,,	4½	4½	79½	—	5 7 0
Lond. & Sub. Trac. 5 % Pref.	1	9½	5	9/-	—	11 2 0
London United Tram. Deb. ...	Stock	4	4	60	— ½	6 13 4
Mexico Trams. 5 % Bonds ...	—	Nil	Nil	78½	—	5 10 9
do. 6 % Bonds ...	—	Nil	Nil	85½	—	Nil
Mexican Light Common ...	100	Nil	Nil	21	−1	Nil
do. Pref.	100	Nil	Nil	53½	−2	Nil
do. 1st Bonds ...	—	Nil	5	66½	—	7 10 3

Manufacturing Companies.

Babcock & Wilcox	1	15	20	2⅛	—	*4 9 1
British Aluminium Ord. ...	1	10	5	18/3xd	—	5 9 8
British Insulated Ord. ...	1	15	15	2½	—	6 0 0
Callenders	1	15	15	2⅝	—	6 6 4
do. 6% Pref. ...	1	6½	6½	27/-	+ ⅛	5 4 0
Crompton Ord.	1	10	5	½	— ⅛	10 0 0
Edison-Swan	1	10	Nil	5/-	+6d.	Nil
do. do. 5% Deb.	Stock	5	5	65	—	7 13 10
Electric Construction	1	10	10	1½	+ ⅛	6 13 4
English Electric	1	8	5	17/3	—	5 16 0
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 3
do. Ord.	1	10	5	18/9	—	5 6 8
Henley	1	15	15	48/-	+6d.	6 5 0
do. 4½ Pref.	5	4½	4½	4⅜	—	5 2 10
India-Rubber	1	10	—	10/-	—	—
Met.-Vickers Pref.	2	8	8	2⅜	+ ⅛	6 2 0
Siemens Ord.	1	10	10	½	—	Nil.
Telegraph Con.	12	20	20	25	—	*5 0 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS FOR CHEMICALS AND METALS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Oct. 17th.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	6d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£22	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4d.	...
a Shellac ... ... per cwt.	£16	...
a Sulphur, Sublimed Flowers ... ,,	£8 10s.	...
a ,, Roll ... ... ,,	£8	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 10s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£115 to £120	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£188	...
Grade II ... ... ,, ,,	£133	...
Grade III... ... ... ,, ,,	£74	...
c Brass (rolled metal 2" to 12" basis) per lb.	92d.	½d. dec.
c ,, Tubes (solid drawn) ... ,,	11¾d. to 1/0	...
c ,, Wire, basis ... ... ,,	10d.	½d. dec.
c Copper Tubes (solid drawn) ... ,,	1/1½d.	...
c ,, Bars (best selected) ... per ton	£92	£2 dec.
c ,, Sheet ... ... ,,	£92	£2 dec.
c ,, Rod ... ... ,,	£92	£2 dec.
d ,, (Electrolytic) Bars ... ,,	£65	45/- dec.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£75	45/- dec.
d ,, ,, H.C. Wire per lb.	9½d.	½d. dec.
f Ebonite Rod ... ... ,,	8/6	...
f ,, Sheet ... ... ,,	8/-	...
a German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	6/6	...
h India-rubber, Para fine ... ... ,,	1/1½	½d. dec.
i Iron Pig (Cleveland Warrants) ... per ton	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£29	30/- inc.
g Mercury ... ... per bot.	£9 5s. to £9 10s.	...
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e ,, ,, medium... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/2	...
p ,, drawn bars and rods ,,	1/3	½d. dec.
p ,, rolled strip & sheet ,,	1/2½	½d. dec.
p ,, wire ... ... ,,	1/3½	½d. dec.
o Platinum ... ... per oz.	£25	...
d Silicium Bronze Wire ... ... per lb.	1/1	...
r Steel, Magnet, in bars ... ... ,,	10d.	...
a Tin, Block (English) ... ... per ton	£204 to £204 5s.	£2 inc.
a ,, Wire, Nos. 1 to 16 ... ... per lb.	3/-	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Fixation of Nitrogen.—The electrical aspect of nitrogen fixation on an industrial scale is an important one, because the electrical energy utilised varies so greatly with the process employed. A French writer, P. Bunet, in the *Revue Générale de l'Electricité*, reviews in turn the several methods and estimates the amount of energy required for each, and the possibilities of initiating some process on a large scale in order to utilise the residual energy from hydro-electric stations and large plants generally. Of course, with modern processes of nitrogen fixation, electricity only plays a secondary part, although large quantities are necessary for power purposes in the Haber and Claude processes and in the more recent process of Casale, an Italian chemist (in which the pressures employed are midway between those used in the other two processes). It has been suggested that the hydrogen required for these processes could be easily obtained as a by-product in the electrolysis of sea water, and by simply electrolysing water. The former of these two methods is already in use on a small scale, though it was fairly extensively used for aeronautical purposes during the war. The writer estimates that a 10,000-kW station supplying an electric railway, where the demand for energy is 120,000 kWh a day, or, say, 5,000 kW mean power, subject to fluctuations, could supply 7.5 tons of fixed ammonia per day, or, say, 6 tons of nitrogen. Thus an appreciable income could be achieved after making allowance for the cost of installation.

With the hydrogen obtained cheaply by the electrolysis of saline solutions in this way, the process of obtaining the fixed nitrogen and, finally, nitrates, could be considerably cheapened.

THE BRITISH ASSOCIATION—VI.

Developments in Wireless Reception.

By J. Scott-Taggart, F.Inst.P.

(Abstract of paper read before Section G—Engineering.)

Part I.—A New Invention for Selective Radio Reception and the Minimisation of Atmospheric Interference.

After a brief review of the methods of reception at present in use, making particular mention of their shortcomings, the author proceeds to describe an invention of his own which involves the increasing, at the receiving station, of the frequency difference between desired and undesired currents. As an example, it is assumed that two stations are working on wave lengths of 15,000 metres and 15,100 metres. The

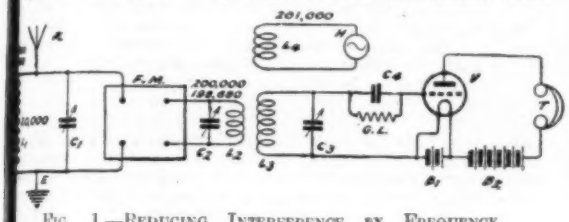

Fig. 1.—Reducing Interference by Frequency Multiplication.

wave length difference, in this case, amounts to 100 metres, a very narrow margin and one which, under ordinary circumstances, would lead to jamming. If now both sets of incoming currents are applied to a frequency multiplier giving a multiplication of, say, 10 times, currents will be delivered to the receiver proper by both sets of incoming currents. The 15,000-metre desired signals will set up oscillations corresponding to a wave length of only 1,500 metres, while the 15,100-metre signals will be resolved into signals corresponding to a wave length of 1,510 metres. There will now be 10 metres difference between the two signals, but 10 metres difference on a wave length of about 1,500 metres is ten times more valuable than a difference of 100 metres at a wave length of 15,000 metres.

The number of cycles difference is the controlling factor in considering selective reception without interference. The example of the 15,000-metre signals being jammed by the 15,100-metre signals may be understood more clearly if we deal in cycles of frequency instead of metres. The 15,000-metre desired signal will set up oscillations having a frequency of 20,000. The 15,100-metre signals will correspond to oscillations having a frequency of 19,868. The frequency difference, therefore, is only 132 cycles. If now, instead of receiving these signals in the ordinary way as, for example, by the heterodyne method, the frequencies of both signals are multiplied by 10, the frequency of the signals due to the 15,000-metres station will be increased to 200,000 cycles, this corresponding to a wave length of 1,500 metres. The 15,100-metres interfering signals will produce interfering oscillations having a frequency of 198,680 cycles.

The difference between the new desired and undesired currents is now ten times as great, and equals 1,320 cycles. The new currents of multiplied frequency may be applied to selective high-frequency receiving circuits and the heterodyne method of reception may be employed. It needs very little imagination for a student of these matters to appreciate the remarkable selectivity which is obtainable by a combination of frequency multiplication and heterodyne reception. A theoretical circuit is illustrated in fig. 1.

In this figure, it is assumed that in the aerial circuit, which contains the inductance L_1 and variable condenser C_1, we have two sets of oscillations. One set has a frequency of 20,000, corresponding to the wave length (15,000 metres) of the desired signals, and the other currents have a frequency of 19,868, corresponding to the interfering signals of 15,100 metres. The circuit is tuned to the frequency of 20,000, corresponding to the desired signals. The next stage in the process is to apply the two sets of currents to a frequency multiplier which is shown, for the sake of convenience, as a box FM. This frequency multiplier may take many forms, and might be a series of frequency-doubling devices, such as valves, or it might be an apparatus for producing harmonics, a selected harmonic being then treated as the fundamental for reception purposes. The output currents from FM pass through the oscillation circuit L_2 C_2, and even here resonance tuning may not be sufficient. Loose coupling between L_2 and L_3 will, however, if the primary and secondary circuits are tuned to the new 200,000-frequency signals—which are really derived from the original 20,000-frequency signals by a multiplication of 10, cause the 198,680-frequency currents, due to the interfering signal which originally had a frequency of only 19,868, to be less effective.

Oscillations are now induced into the circuit L_3 C_3 from the heterodyne H, which may be, for example, a valve oscillator. This heterodyne induces local oscillations having a frequency of 201,000. The result of inducing currents of this frequency into the circuit L_3 C_3 will be the production of two sets of beats. The 201,000-frequency oscillations will beat with the desired 200,000-frequency oscillations producing beats of 1,000 frequency, and these beats will be rectified and detected by the valve V, in the output circuit of which are the telephone receivers T. The 1,000-frequency beats will, of course, produce a musical note in the telephones T having a frequency of 1,000, which is a very convenient frequency for the reception of continuous wave signals. The 201,000-frequency oscillations induced by the local heterodyne, will also produce beats with the oscillations having a frequency of 198,680 which, it is assumed, have not been tuned out by the use of resonance phenomena. The beats, in this case, will have a frequency of 2,300.

There are now in the telephones T two sets of signals. The desired sets have a frequency of 1,000, while the undesired ones have a frequency of 2,300, and no difficulty should be experienced in reading the desired signals without material interference from the other signals.

A far more striking example of the possibilities of this new principle in wireless reception is when we consider the frequency multiplication to be, say, 100 times. Such conditions can be obtained. The advantages to be gained from the method outlined in this paper are supplemented by resonance tuning, and in practice a frequency multiplication of 100 times would not be necessary. By doubling the frequency of the incoming signals twice as many channels of communication are rendered available in any given band of wave lengths.

By the application of this invention to long-distance communication, it would therefore seem that the problem of the congestion of the either has been solved. The principle is just as applicable to audio frequencies as to radio frequencies.

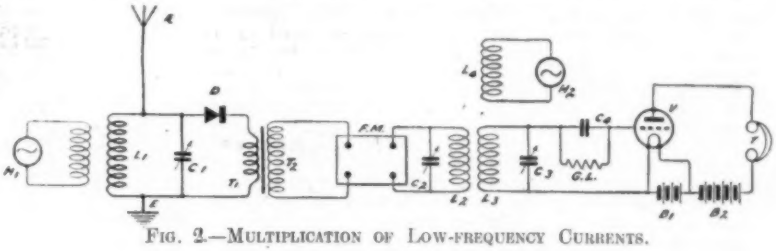

Fig. 2.—Multiplication of Low-frequency Currents.

The author's experiments in this direction have fully borne out theoretical expectations, and two signals having a note frequency imperceptibly different have been entirely separated in such a way that one of the frequencies is entirely suppressed.

The original audio-frequency signals have their frequency stepped-up by means of harmonic producing, or other frequency-multiplying apparatus, to a radio frequency which should preferably be well above the audible limit. These

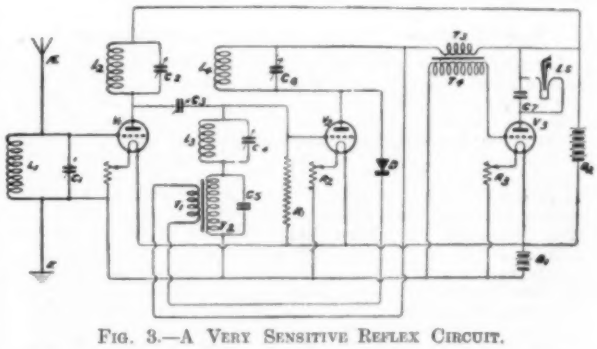

Fig. 3.—A Very Sensitive Reflex Circuit.

radio-frequency currents may now be selectively received by the aid of tuned high-frequency circuits and then combined with local radio-frequency continuous oscillations. These local oscillations are produced by a heterodyne, beats being produced. All the advantages of high-frequency tuned circuits and beat reception are thereby obtained, and whereas the original difference in frequency might be only 100 (barely perceptible) the final difference in frequency might be 10,000, a frequency which would enable the interfering signals to be cut out entirely.

Fig. 2 shows a theoretical wireless receiving system in which the invention is applied to the low-frequency currents. The high-frequency signals are rectified by the crystal D

producing audio-frequency currents through T_1, due to the fact that a local oscillator H_1 induces continuous oscillations into the aerial circuit of a frequency slightly different from that of the desired signals. The currents of musical frequency passing through T_1 are then applied by means of the transformer T_1 T_2 to the frequency multiplier F M, in the output circuit of which we have a circuit L_2 C_2 tuned to a multiple of the desired audio-frequency currents passing through T_1. The circuit L_2 C_2 will be a radio-frequency circuit, and the frequency of the currents in L_2 C_2 should preferably be above the audible limit. The circuit L_3 C_3 is is tuned to the same frequency, and by loosely coupling L_2 to L_3 a certain amount of resonance selectivity is obtained.

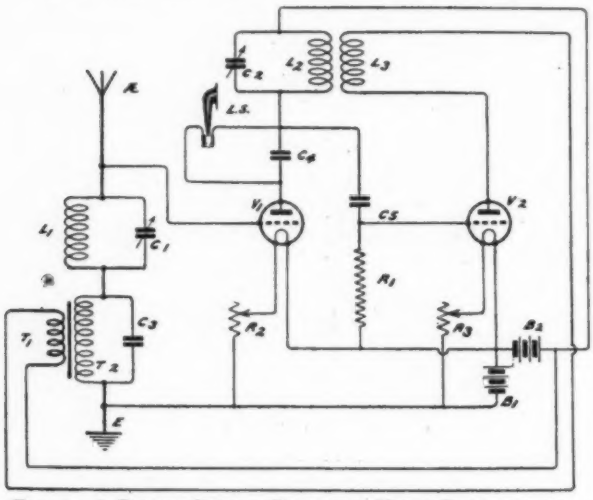

Fig. 4.—A Reflex Circuit Employing Valve Rectification.

The principal method of obtaining the selectivity, however, is by the introduction of local oscillations produced by a second heterodyne H_2 tuned to produce currents having a frequency differing by, say, 1,000 from the currents in L_3 C_3. The beats of about 1,000 frequency are now detected by the valve V and produce a musical note in T. The beats produced by the interaction of the local oscillations supplied by H_2 and the undesired signals of multiplied frequency are arranged to be above or below the audible limit so as not to interfere with the desired signals. It is, of course, possible and convenient to apply the invention to both the high- and low-frequency sides of a wireless receiver.

The system of reception lends itself particularly to the elimination, or rather minimisation, of atmospherics; the process of atmospheric elimination is essentially one of selectivity. The application of the method of frequency multiplication to the low-frequency side of a receiving circuit will automatically cut out all, or most, of the atmospherics, owing to the fact that most atmospherics have lower frequencies than the heterodyne notes due to desired signals. Unless their frequency exactly corresponds with the heterodyne note, the process of frequency multiplication and resonance, combined with further heterodyning, will eliminate the atmospheric interference.

Part II.—Reflex Circuits for Broadcast Reception.

A very useful application of the three-electrode valve is as a dual amplifier of both the high-frequency currents and the low-frequency currents at the same time. Dual-amplification circuits possess the merit of saving one or more stages of separate low-frequency amplification; in other words, fewer valves may be employed. Unfortunately, the additional duties which the valve has to carry out tend to render it unstable, and low-frequency oscillation and distortion are frequently the accompaniment of dual amplification. To lessen the tendency to oscillate, a stabilising resistance of about 100,000 ohms can be connected across suitable points in the circuit, while the transformer for introducing the low-frequency currents into the grid circuit of the valve is connected in the aerial circuit of the usual direct-coupled receiver. The author first describes the S.T. 100 circuit, which was fully dealt with in our issue of July 20th last, p. 115.

Fig. 3 shows a modification of the circuit by the addition of a stage of high-frequency amplification which is desirable when long ranges are to be accomplished. It will be seen that the first valve acts as a high-frequency amplifier. The circuits L_1 C_1, L_2 C_2, and L_3 C_3 are all tuned to the incoming wave length. The circuit L_4 C_4 is also tuned to the incoming wave length. The second valve acts as a high-frequency amplifier, the high-frequency oscillations in L_4 C_4 being detected by the crystal detector D. The resulting low-frequency pulses pass through the primary T_1 and the low-frequency signals are then impressed on to the grid of the second valve which amplifies them; the amplified currents pass through T_2 and are communicated to the grid of the third valve, in the anode circuit of which is the loud-speaker L. The stabilising resistance R_1 has a value of about 100,000 ohms.

Fig. 4 shows a very efficient example of a class of dual amplification circuit which does not involve the use of a crystal detector. In this case the incoming signals are amplified by the valve V_1, the amplified currents appearing in the circuit L_2 C_2. The high-frequency potential variations across L_2 are communicated to the grid of the second valve V_2 by means of the condenser C_5, a gridleak R_1 being connected across the grid of the second valve and the positive side of the accumulator. This second valve acts as a detector, and an inductance L_3, coupled to L_2, is included in its anode circuit in order to introduce reaction into the tuned anode circuit L_2 C_2. The rectified currents also pass through the primary T_1 of the intervalve transformer T_1 T_2, the secondary of which is connected in the grid circuit of the first valve which consequently acts also as a low-frequency amplifier. In order to detect the signals the loud-speaker LS is included next to the anode of the first valve, the condenser C_4, of about 0.05 μ F being connected across the loud-speaker. The value of these condensers across loud-speakers varies with the different types of reproducer used.

Very good results have been obtained with this circuit, and it is possible to arrange a modification in which the third valve acts as an additional low-frequency amplifier. In order to be able to touch the telephone receiver terminals or the loud-speaker terminals without any influence whatever on the signal strength, the circuit of fig. 5 was evolved. The tuned anode circuit, as before, is represented by the inductance L_2, shunted by the variable condenser C_2. Instead, however, of connecting the loud-speaker or telephone receivers directly next to the anode of the first valve, two additional coils L_5 and L_4 are connected in the manner shown; the inductances L_3, L_4, and L_5 are all wound on the same tube of insulating material. The coil L_4 is wound directly over L_5 and is identical with it, as regards numbers of turns, &c. The coil L_5 is likewise the same as L_4 and is wound over L_4.

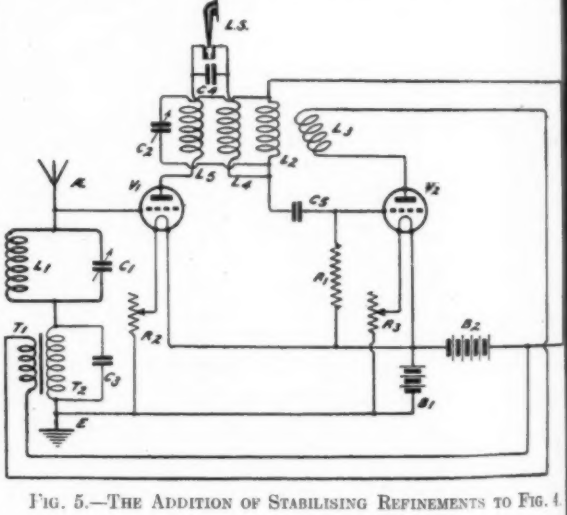

Fig. 5.—The Addition of Stabilising Refinements to Fig. 4.

For British broadcasting purposes it was found that each of the coils L_3, L_4, and L_5 could consist of 30 turns of No. 36 gauge double-cotton-covered wire wound on a 3½-in. diameter ebonite tube. The coil L_3, as before, is coupled to L_2 to produce the reaction effect.

In conclusion, it may be stated that the manifest advantages of using a three-electrode valve as a reflex amplifier are being rapidly appreciated, and it is highly likely that the use of this type of circuit will be widespread in the immediate future.

Vocational Tests for Engineering Trades.

An interesting discussion on this subject took place on September 13th, at a joint meeting of Sections J and G—Psychology and Engineering.

The opening address was given by Mr. M. H. Tagg, of the National Institute of Industrial Psychology, who gave a brief outline of conclusions drawn from an investigation which had been carried out to determine the general fitness of a certain number of students in engineering schools for the trades of pattern making, turning, tool making, and drafting. In carrying out this investigation, the following four factors were taken into account:—(1) General intelligence; (2) specific abilities which could not be classed under general intelligence, but which were necessary for the performance of some particular operation; (3) what, for want of a better term, Mr. Tagg called temperament dispositions; and (4) the physical factor, *i.e.*, physique, sight, &c.

The general conclusions arrived at were that the stock laboratory tests were usually too artificial and too restricted, and were of no great use in vocational training. Group tests such as those carried out were best fitted for a rough sorting-out of

the candidates; individual tests must be made for finer adjustments. The tests were carried out on youths in college because it was not felt right to ask any employer to place men at the disposal of the investigators for the purpose. The point at issue in this matter, of course, was whether vocational tests carried out on the basis of psychological tests and an examination could take the place of the usual period of probation. From the discussion, it seemed that the psychologists took one view whilst practical engineers took the other.

Messrs. A. P. M. Fleming and H. J. Brocklehurst, of the Metropolitan Vickers Electrical Co. explained the method of selecting apprentices adopted by that firm. Three tests were applied, *viz.*, general intelligence, general physical fitness, and interest in the trade. The main point put forward was that steps should be taken to interest boys in engineering and other trades whilst they were at school, their experience being that those boys who had their interest awakened and stimulated in any particular trade whilst they were at school, almost invariably desired to enter that trade and do well at it. These speakers regarded the six months probationary period as slow, and to some extent clumsy, but they admitted that it was working effectively, especially in a well-conducted works. Their chief point, however, was that in the endeavour to stimulate the interest of boys in trades, lectures should be given in the schools by industrialists, and that teachers should be encouraged to visit works in order to be able to give the boys information. They also expressed the view that the psychological tests alone could not determine a boy's fitness for any particular task.

Mr. J. G. Taylor (Vickers, Ltd.), speaking of the three main methods for determining a boy's fitness for a trade, *viz.*, an examination of the school record, an interview, and an examination of the candidate, said he did not place much reliance upon the first, and preferred the examination and interview combined. One of the difficulties was that boys came from different classes of school, some of which devoted more attention than others to engineering subjects. Thus the boys from these schools, and from the junior technical schools, did better than the boys from the other schools, and that was a factor to be taken into account.

Sir Henry Fowler, after expressing satisfaction at the holding of this first joint meeting between the sections, said that there was a great deal in common between engineers and psychologists in relation to the selection of suitable boys as apprentices. He held the opinion that the personal interview was the most important and reliable of the methods now available for deciding upon the vocational fitness of a boy. It was very necessary, however, to devise some method for eliminating the nervousness which so many applicants felt when being interviewed or examined. Then again, there was work for the psychologists with regard to monotony in engineering work. The present type of education was such that it was doing away with the type of individual who liked a monotonous job. He had known some such men, but they were fast disappearing, yet there were monotonous jobs to be done.

Prof. F. C. Lea remarked that psychological tests were not always accurate, and thought that the best method was to watch the boys at school and make a selection in that way.

On the question of the interviewing of the candidate, several speakers pointed out that there was room for a good deal of improvement in the manner in which the interviewer carried out his work, and one went so far as to suggest vocational tests for interviewers.

Sir James Henderson did not approve of vocational tests taking the place of the probationary period. He would double the number of apprentices even if he had to reject half of them at the end of the probationary period.

Prof. F. G. Baily urged that nothing but the probationary period could discover whether a boy had that "horse-sense" which was so essential to an engineer.

Several psychologists took the opposite point of view, and stated that the aim of industrial psychology was to reduce the probationary period. In Germany, the majority of large firms were said to engage their apprentices on the basis of psychological vocational tests, and it was added that even if there were a few failures here and there, this did not condemn the vocational test as a substitute for the probationary period. In favour of the vocational test was placed the advantage to the youth in that he had not to waste a long time in finding out his fitness for his job. Moreover, when at the end of one six months' probational period a boy was rejected, was he to start all over again, and what was to become of him?

Population and Unemployment.

By Sir William Beveridge.

(*Abstract of address delivered before Section F—Economics.*)

After pointing out that many people believed that the limits of population in this country had been reached, the speaker proceeded to show why this conclusion was unjustified. As regarded unemployment, although it reached 15 per cent. in 1922, yet it averaged over 11 per cent. in 1879, and this was followed, not by over-population or the downfall of British industry, but by a period of exceptional expansion and prosperity. Unemployment and over-population were two quite distinct problems, and it was quite impossible to argue from one to the other without considering many other factors which affected national and world conditions.

Sir William then considered Mr. J. M. Keynes's view of post-war conditions in Europe, as set forth in the "Economic Consequences of the Peace." He quoted the views of Mr. Keynes that Europe was already over-populated before the war and that the law of diminished returns was already making itself felt in a tendency of cereals to rise in real cost. He then referred to the statistics of agricultural and industrial production in this country, in Europe, and in countries settled from Europe, for the period from 1880 to 1910. The results indicated a steady and marked increase, not only in population and acreage under corn, but also in yield per head of population as well as per acre, while the output in coal, iron and steel increased still more rapidly during the same period. On the other hand, since the war wheat production and acreage under cultivation in Europe had gone back to where they stood forty or fifty years ago, while in the newer countries, during the last decade, the acreage under crops and the yield per acre had continued to increase, the yield per head of population only decreasing slightly. If these and other statistics which were quoted were correct, it would appear that Mr. Keynes's fears of approaching over-population were baseless. The speaker then examined the economic position of Britain before the war. Using such indices as the production of coal, pig-iron, and shipping, he found an almost unbroken rapid rise in production until 1900, followed by a slower rise or no rise at all during the next decade. This hiatus in our progress during the Edwardian period was accounted for by changes in education and the labour supply, by the South African war and an upward turn of prices, but it was argued that in the last three years before the war nearly all indices of production resumed a rapid upward movement.

Turning to post-war conditions Sir William Beveridge pointed out that the optimum density of population for any country depended not merely on its own resources and the degree of their development, but also on how it compared in these matters with other countries. In Britain, as the least self-sufficient and most highly specialised of countries, this principle was most clearly illustrated. The present unexampled amount of unemployment was not a result of high fecundity. There were abundant lands waiting to be populated. The present unemployment was rather a result of the difficulties in passing from war to peace conditions; and secondly, the damage done by the war to the economic structure. We had travelled too far along the road leading away from self-sufficiency to retrace our path by diminishing our population, growing more corn, and doing less trade. The solution was rather in recognising more fully our dependence on international trade and endeavouring to restore conditions in which it could be resumed. The middle course of self-sufficiency within the British Empire depended for its fulfilment upon the wishes of its various parts.

Analytical and Experimental Investigations Relating to Water Turbines.

By Hubert Mawson, D.Sc., (Lond.).

(*Abstract of paper read before Section G—Engineering.*)

A water turbine rotating with the guide blades fixed in one position acts as a reversed centrifugal pump, and under such conditions should obey similar laws to those governing the action of a pump. The Francis mixed flow reaction turbine at Liverpool University, which is rated to give 15 b.h.p. at 900 r.p.m. under a head of 60 ft., and can be controlled by hand or by governor, was utilised to verify this law. In these experiments the hand-regulating device was used to alter the position of the guide blades. In the first series of experiments constant speed tests at 900 r.p.m., 800 r.p.m., 700 r.p.m., and 600 r.p.m. were made under a head of 59.7 ft. and the power was varied by moving the guide blades. When the results were plotted on a gate-opening base, the points connecting the gallons per minute with the gate opening fell on a straight line passing through the origin for all the speeds of rotation and for gate openings varying from one-sixth to full gate. Other experiments also showed that, except for very small gate openings, the quantity of water supplied per minute varied as the gate opening when the head and revolutions per minute were constant. From constant speed tests at maximum gate the law for this turbine was found, and the experimental values for constant head curves at various gate openings and speeds were shown to be in close agreement. Close agreement was also established by experiments conducted under the following conditions: (*a*) Constant vane position curves for different gate openings from one-sixth to full gate at a head of 59 ft. and speeds ranging from 300 to 1,400 r.p.m. (*b*) Guide blades full open for different constant torques applied to the shaft ranging from 14.2 lb.-ft. to 93 lb.-ft. with heads from 12 to 60 ft., and speeds ranging from 350 to 1,400 r.p.m. (*c*) Guide vanes full open with constant heads of 50 ft., 40 ft., 30 ft., and 20 ft., with speeds ranging from 300 to 1,300 r.p.m. Formulæ have been developed by means of the characteristics of similar turbines can be calculated.

The next part of the paper deals with speed regulation. For driving generators a constant speed is required at all loads. The governor mechanism is heavy, generally, and the governor has to control a large mass of moving water, the sudden

retardation of which may cause an excessive increase of pressure in the pipe lines. This rise of pressure tends to make the turbine rotate under an increased head, and therefore at a higher speed. Hence the design of the governor to satisfy these conditions and keep both the speed of the turbine and pressure in the pipe lines within reasonable limits is nearly as important as the design of the turbine itself. The main considerations to be taken into account are: (*a*) The dead time of the governor, which is the time which elapses between an alteration of the load and a movement of the turbine gates; (*b*) the closing time, which is the time taken to close the gate from full load to zero gate; (*c*) the increase or decrease of pressure in the pipe lines following a movement of the gates; and (*d*) the increase or decrease of the speed of the rotating parts. An analysis enabling these points to be studied is given. To measure the variations in pressure in the pipe lines, and the speed of the turbine when the load was removed and the governor operated, the following apparatus was used: To the turbine shaft a worm was fixed, and this geared with a spur wheel to which a drum was attached. On the planed surface of a table a slide was constrained to move backwards and forwards parallel to the axis of the drum, and was operated by a hand wheel which turned on a screw. The slide carried an electrically-maintained tuning fork and an electromagnet which, when excited, attracted a pen to the paper on the drum. Two other electromagnets were placed in the same circuit as the first; one, when excited, held a pendulum at its outermost position and when the current was broken allowed the pendulum to oscillate. The other controlled a pen which made a mark on an endless band of paper wrapped round a small drum, which was rotated by a small electric motor. An indicator replaced the pressure gauge in the pipe and recorded pressures on this band of paper. The two pens were brought into contact with their drums and the pendulum held in the dotted position by an insulated cup on the first electromagnet. When the circuit was cut the brake load fell, the circuit was broken, all the pens were lifted from their respective drums, the cup holding the pendulum fell, and the pendulum commenced vibrating. At the centre of its swing it passed through a mercury bulb, remaking the circuit, which brought the pens momentarily into contact with their drums, giving a good time record when the periodic time of the pendulum was known. Coupled to the same connection as the indicator was another indicator, on whose drum a record of the pressure against gate movement was obtained.

From the results given it is seen that the revolutions per minute, when the turbine settles down, may be much below the maximum speed attained, and that, for close regulation of speed, it is a distinct advantage to allow the gates freedom to overrun the final settling down position. When the initial conditions, the dead time and the closing time, are known, this method enables approximate values to be obtained quickly.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS AND MACHINERY IN SEPTEMBER, 1923.

The value of British electrical exports for September, as recorded in the Board of Trade returns, reached £967,260, an increase of £107,603 on the previous month, and £189,253 higher than in September, 1922. As compared with August, nearly all sections of electrical exports show considerably increased values, principally in the sections for electrical goods and apparatus (£100,000 increase), insulated wires and cables (£66,000 increase), electrical machinery unenumerated (£44,000 increase), considerable increase also occurring in glow lamps, batteries and accumulators, meters and instruments, other motors and generators, switchboards and telegraph and telephone cable (not submarine); the only sections in which decreases occur are railway and tramway motors, nearly £1,000 decrease, and submarine telegraph and telephone cable, £174,334 decrease. As compared with September, 1922, increases occurred in all sections with the exception of carbons (decrease £2,598), other motors and generators (£1,018 decrease), and telegraph and telephone apparatus £46,658 decrease).

The electrical exports for the first nine months of 1922 and 1923 were:—

Exports.	1922.	1923.
Electrical goods and apparatus	£5,382,340	£6,039,466
Electrical machinery	£3,222,309	£2,777,816
Totals for nine months ...	£8,604,649	£8,817,282

The total weights of electrical machinery exported during the first nine months of 1922 and 1923 were 12,566 and 14,289 tons respectively.

Electrical imports for September totalled £318,166, an increase of £77,110 on the August figures, and £117,234 on the totals for September, 1922. As compared with August, the only sections in which decreases occur are those for carbons and telegraph and telephone wires and cables.

In comparing the September electrical import figures with those for 12 months ago, it will be seen that the principal increases occur in the sections for electrical goods and apparatus, electrical machinery unenumerated, and telegraph and telephone instruments and apparatus.

The electrical import figures for the first nine months of 1923 were:—

Imports.	1922.	1923.
Electrical goods and apparatus	£998,463	£1,640,108
Machinery	£983,220	£779,729
Totals for nine months ...	£1,981,683	£2,419,837

The re-exports of foreign and Colonial electrical goods and machinery for September totalled £16,211, an increase of £3,940 on the previous month and £4,441 more than in September, 1922.

The electrical re-export figures for the first nine months of 1922 and 1923 were:—

Re-exports.	1922.	1923.
Electrical goods and apparatus ...	£130,673	£73,991
Machinery	£35,416	£79,485
Totals for nine months ...	£166,089	£153,476

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Sept., 1923.	Inc. or dec. as compared with August, 1923.	Inc. or dec. as compared with Sept., 1922.	Electrical imports for Sept., 1923.	Inc. or dec. as compared with August, 1923.	Inc. or dec. as compared with Sept., 1922.	Electrical re-exports for Sept., 1923.	Inc. or dec. as compared with August, 1923.	Inc. or dec. as compared with Sept., 1922.
Electrical goods and apparatus (unenumerated)	£163,173	+£100,375	+ £63,262	£84,303	+ £18,264	+ £47,436	£3,567	— £87	+ £796
Insulated wires and cables ...	178,499	+ 66,830	+ 52,959	35,233	+ 10,387	+ 9,696	169	— 41	+ 119
Glow lamps	35,258	+ 14,552	+ 6,755	17,912	+ 4,146	+ 3,537	827	+ 529	— 278
Arc lamps and parts	256	+ 165	— 437	829	— 148	— 966	262	+ 262	+ 97
Batteries and accumulators ...	46,030	+ 14,061	+ 2,016	17,992	+ 5,514	— 621	450	+ 406	—
Meters and instruments ...	28,504	+ 4,283	+ 8,664	6,693	+ 561	+ 1,460	687	+ 532	— 152
Carbons	4,093	+ 625	— 2,598	8,776	— 2,398	+ 7,604	53	+ 25	— 425
Electrical Machinery—									
Electrical machinery (unenumerated)	137,615	+ 44,393	+ 20,848	100,938	+ 28,012	+ 29,494	6,847	+ 136	+ 2,602
Railway and tramway motors	30,855	— 977	+ 11,371	—	—	—	—	—	—
Other motors and generators ...	116,596	+ 5,546	— 1,018	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	9,239	+ 6,966	+ 278	—	—	—	48	+ 48	+ 48
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	63,362	+ 22,449	+ 32,544	3,423	— 2,077	+ 1,426	1,022	+ 1,022	+ 1,022
Submarine telegraph and telephone cable	46,223	— 174,334	+ 41,267	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	107,557	+ 2,669	— 46,658	42,067	+ 14,849	+ 18,168	2,279	+ 1,108	+ 612
Totals	£967,260	+£107,603	+£189,253	£318,166	+ £77,110	+£117,234	£16,211	+ £3,940	+ £4,441
Increase or decrease for the eight months ended September, 1923.		Exports. + £212,633.			Imports. + £438,154.			Re-exports. — £12,613.	

THE INSTITUTION OF WELDING ENGINEERS.

FIRST MEETING.

The above-named Institution, which was formed a few months ago, held its first ordinary meeting on October 10th under the presidency of Sir Peter Rylands. We refer to the formation of this new Institution in our leading columns. At the meeting on October 10th the presidential address was followed by the reading of two papers on gas and electric welding respectively, and the following are extracts from the proceedings so far as they affect electric welding:—

Presidential Address. (*Abstract.*)

Sir Peter Rylands, in the course of his presidential address, said that the future alone could decide whether the Institution was well founded and whether it provided a link at present lacking between British scientific societies. The movement had been subjected to the criticism that it overlapped work adequately performed by existing bodies, and that the formation of a definite welding institution was unnecessary and even mischievous. In any case they found themselves in good company, as what America and France had found beneficial there seemed no reason why Britain should not find equally advantageous.

A new technical institution in any branch of art or science could only be justified by the existence of a field for research presenting possibilities capable of being profitably translated to the needs of industry. He could not speak as a trained expert upon welding, but perhaps in a matter of this kind a position of detachment might be an actual advantage. It seemed to him that the art of welding impinged upon, if it did not actually enter, a field of science not only not covered by any scientific society, but one in which investigation was only in its earlier stages. He referred particularly to the ultimate constitution of matter. The final problem to be solved by welders was the achievement of a weld indistinguishable from the adjacent metal. The process by which that aim might be accomplished, practically, was immaterial from the point of view of the Institution of Welding Engineers. The field was a vast one and far from being fully explored.

At the present time there was a healthy rivalry between the methods of acetylene and electric-arc welding, but those methods ought to be complementary; indeed, that was what he found from the practice in the group of works with which he was associated; the two processes were used side by side, experience determining which was best applied to a particular kind of work. Ultimately their present methods might be superseded by some entirely different process. The extraordinary investigations into the ultimate constitution of matter which had taken place during the last few years might bear fruit in helping them to arrive at that perfect condition of welding by which they might be enabled to get complete molecular uniformity throughout a welded body or structure. Both the electric-arc and the oxy-acetylene methods of welding had their appropriate fields, and it would be one of the functions of the Institution to assist the development of both methods. From the evidence available it would appear that gas welding would always prove more convenient in carrying out multitudinous small repairs, while for large constructional work and in other directions the electrical process might prove more suitable. When rapidity of deposition and a minimum of heat diffusion were desirable the electric-arc process, of course, had advantages.

It was not the object of a technical institution to interfere with the freedom and individuality of those commercially engaged in the art. Its object was to provide a means by which new ideas could be ventilated and discussed. Scientific papers rarely contained suggestions capable of immediate commercial application. They provided the starting point from which a new idea could be developed, by discussion and experiment, into commercial use. The function, therefore, of the Institution of Welding Engineers would be to invite all scientifically interested in the art to present papers for discussion. The Institution, however, was not confined to the consideration of processes relating alone to iron and steel, and it would develop all kinds of investigation into the best methods of welding other metals and alloys. Perhaps one of the most important lines of investigation was in the direction of finding some ready means by which welded joints might be tested *in situ*. X-rays appeared to be of use only in showing up voids and inclusions in metals, without giving much indication as to either the physical or the chemical constitution of the deposited metal.

It was fairly certain that the development of welding was being retarded by the lack of adequately-trained operators. There was no doubt that a good deal of skill was required if uniformly good welding was to be carried out by the operator, and in this direction the Institution of Welding Engineers could do a great work in encouraging the proper training of men and in developing a definite class of expert operators.

The Choice of an Efficient Electric Arc Welding System.

By D. T. Smout, A.M.I.E.E., M.I.W.E. (*Abstract.*)

Commercial efficiency of the arc welding process can be roughly estimated by the relation that the quality of the work possible bears to the cost entailed. The chief factors deciding the quality of the work are:—

Electrodes.—Generally speaking there is a sphere of utility for each type and provided care is exercised in their selection maximum efficiency in the weld should result. The bare type, while imposing a minimum thermal load, requires the presence in the plant of a high stabilising factor, whereas the heavy slag-depositing types impose a maximum thermal load and demand a lower stabilising effect from the machine. It appears doubtful whether it will ever be possible to produce an electrode which combines the good points and at the same time eliminates the bad features of each type, and therefore it would appear that each type must be provided for to ensure maximum welding efficiency.

Current (whether direct or alternating).—With d.c., using an electrode coupled to the positive pole, maximum speed of deposition is obtained, but the penetration or heating effort on the work is a minimum. A change in polarity results in a reversal of these conditions. Other factors being equal, speed of deposition and depth of penetration lie midway between these extremes for a.c. current. It is customary to connect the positive pole to the work when using bare wire, and to the electrode when using heavy slag-depositing wire. There is no choice with a.c., which might be a serious argument against its use if the penetrative effect with bare wire were insufficient for good welding. This is not so, however, provided it is guarded against by using an efficient welding machine. It is true that greater speed of deposition can be obtained with d.c. when using heavy slag depositing wires, but as the penetrative effect with bare wires (using the negative connected to the work) is too low for efficient welding, a.c. enables the deposition of the intermediate types of electrodes to be carried out more efficiently than is possible with d.c. These statements are dependent on the arc stability factor being equal in each case, in considering which the author suggests that up to a certain point the subject lends itself to mathematical treatment, and he has endeavoured to point a way in this direction in the appendices. The conclusions arrived at appear to show that the stability factor provided by a certain type of a.c. welder can be definitely expressed as a numerical quantity and that although it is possible, perhaps, to obtain a greater stability factor from a d.c. machine, it does not always obtain in practice. It is interesting to note that the theory explains why a transformer and choke combination is inferior in every way to this particular type of plant and probably explains the reason why the statement that "Flux-coated electrodes are essential for alternating current" is not strictly correct. The author suggests that instead of "alternating current," the text should read "a transformer and choke machine." If the foregoing statements are accepted it appears that for equal stability factors d.c. is preferable for use with bare wire and heavily-coated slag-depositing wires, while a.c. is more suitable for the intermediate types.

The Welding Machine.—The theories set out in the appendices appear to indicate that, provided that the design of the machine allows (on the lines indicated) for the correction of fluctuations due to power supply variations and also for those set up by operation, there should be no reason why a.c. current should not give as stable an arc as d.c. Correcting for fluctuations due to operation can be likened to mechanical governing, whereas correcting factors for counteracting power supply fluctuations are obtained by balancing.

Not only should the power control feature of the plant or the "governor" be adjustable for various loads, but the speed or voltage should be adjustable as well to suit the type of electrode. The governing must be sensitive, but, unfortunately, characteristic curves can only show how far the machine is actuated by good intentions and do not show how far the machine will go when pushed to carry them out. What is wanted is a method of assessing the value of the stabilising factor. The author suggests that it should be possible to devise a standard artificial load for obtaining something in the nature of a cycle diagram whereby the stabilising factor could be expressed as the coefficient of the fluctuation of load.

It has been shown that whether the control feature be resistance or reactance the period of zero power in the arc will exist for an appreciable period. This feature is extremely bad for arc stability and bare-wire welding is impossible with such plant. The transformer described in Appendix III not only limits this period of zero power to negligible dimensions, but supplies a stabilising factor in the machine which operates with no sensible time lag over the whole load cycle, and therefore the stability of the arc maintained by this machine, is equal to that of any d.c. proposition. The method is novel and consists of an a.c. controlled by a variable reactance. The

reactance variation is obtained by arranging part of the secondary winding so that on open circuit it becomes linked with the primary flux, whereas on load a large proportion of the primary flux is forced through another limb of the core instead of through this part of the secondary. Under certain conditions the whole of the primary flux is in this way diverted when the maximum value of the current is reached, and therefore for a change of current from maximum to zero this part of the secondary is cut not only by the flux produced by the current at maximum, but also by the primary flux which becomes linked with it on zero secondary current. This part of the secondary winding performs on open circuit the same function as that of the secondary of any constant-potential transformer, whereas on full load it acts as a choke coil. It follows that its reactance value as far as average values are concerned is approximately half the full-load value, and this will give the general characteristic of the plant illustrating its abilities to cope with fluctuations due to operation. The variation of reactance over the half cycle of operations acts to restrain the voltage rise as the forward e.m.f. tends to rise above the arc voltage, and to aid the forward voltage as it tends to fall.

Provision is made in this transformer to adjust for load, type of electrode and reactance energy. In the case of a.c. machines the special transformer described is ideally suited.

Discussion.

Major J. Caldwell agreed with Mr. Smout that the electrode was the most important factor in electric welding, but it was a very small part of the operation. In repair work, he said, the cost of the electrode was about 5 per cent. of the cost of the complete work, but in constructional work the cost of the electrodes would be more, certainly, if good quality work was required. With regard to slag or flux-covered electrodes, for some considerable time they would have to be guided more or less by the methods adopted in steel manufacture, because electric arc-welding was really the manufacture of a steel casting, and if the same results were to be obtained they must adopt the same precautions and the same approved methods, modifying them for the minor operation of welding as compared with steel manufacture. He appreciated the stress placed by Mr. Smout on the use of a.c. for welding. An a.c. machine at the recent Shipping Exhibition, which had not been previously exhibited, was the Daysohms low-pressure arc welder; the special points of that machine consisted in the fact that owing to its being possible to set the striking and welding currents independently, and that the keeper was free to move between the striking and welding stops against the control of a dash-pot, a composite characteristic curve was obtained which was the resultant of the two curves that would have been obtained if the keeper had been fixed in either position. The curvature of the composite characteristic curve could be varied by regulating the speed of the dash-pot by means of perforated disks on the plunger, the result being that it was possible to weld with a lower open-circuit voltage, as well as thinner material (without burning through it) owing to setting the striking current very little in excess of that required for welding. By that means it was possible to weld as low as 19 gauge metal with a.c.

Mr. E. A. Atkins expressed the view that it would not be at all a bad plan if the Institution of Welding Engineers had a publicity expert, who could continually let different firms know and understand what it was possible to do with the various systems of welding. A welder ought to know a good deal more about the metals he had to weld, and then perhaps he would understand better how to treat them, especially with regard to expansion. Why was such a large quantity of lagged electrodes used when an electrode with a thin coating of flux on the surface would do equally well? The thinner the coating on the electrode the smaller was the current bill, and some rule should be laid down so that they could know which of the varied electrodes should be used.

Mr. E. C. Coke spoke of the need for training welders, and whilst agreeing that there were certain electrodes for certain jobs, he thought something could be done in the way of dispensing with the flux or covering on the electrode and using a paste or paint which could be put on the job.

Mr. T. Smith said that no one could ever feel sure that a welded product was safe. There was a tendency to-day to think that everybody could learn everything about any part of engineering in six weeks. Could the knowledge which a welder should possess be got from the apprenticeship system? Technical colleges and universities did not touch the practical side; why did not the industrial men of the country take more interest in such institutions and see that more was done in that line? This led him to attack the growth of specialist societies, and ask whether the whole subject of welding could be covered by a specialised institution. One would have to carry a dictionary around in order to find, from the letters after a man's name, what institutions he belonged to, and he suggested that in the future such letters might be used as a substitute for skill. The true specialist was the man with an all-round knowledge.

Mr. R. Worsam said he would be glad to meet anybody who had really welded copper successfully—he did not mean small pieces which could be folded over, but copper articles which could be hammered and worked and planished afterwards, without the weld showing any weakness.

Mr. E. S. Marquand dealt with the industrial status of welding. While welding was practised very successfully in many directions it was not really understood. Welding as an industry could not advance much further until they evolved a scheme which would meet the demand for the skilled labour necessary. He looked to the Institution to do good work in that direction. The metallic arc system after the application of from 175 to 200 amperes became unwieldy, and the carbon arc then stepped in. Successful work was being done in welding cast-iron with the carbon arc against the oxy-acetylene blowpipe. The conditions were very much the same, after all, in that they used the oxy-acetylene blowpipe or the carbon arc as a heating medium. If an article were preheated equally good work could be done with the graphite arc, using—depending on the section to be welded—from 30 up to 600 amperes or more. But, if anything, a quicker heat could be obtained with the carbon arc than with the oxy-acetylene blowpipe. If those in charge of welding, before they criticised their workmen, would themselves set out thoroughly to understand the technique of welding, they would have less failures.

Mr. A. E. Shorter pointed out that the stabilising of the arc was an essential feature. In extensive electric welding operations on tramways he had used large quantities of high carbon bare steel electrodes containing as much as 1.1 per cent. of carbon, and had obtained highly satisfactory welding results. On a long length of track in this country, working under a half-minute service, the welding work was to-day, after a period of two years, as good as when it was first done. For certain jobs it was absolute waste to use expensive coated electrodes. With regard to copper welding, there was a bare copper alloy electrode with which highly satisfactory results were obtained.

Captain D. Richardson (R.A.F.) congratulated the Institution on getting a logical analysis of arc welding systems. As to training welders, he did not agree with apprenticeship, because any training that a man received with one firm was liable to be very biased.

Mr. D. T. Smout, replying to the discussion, said that not only perfect work, but also the commercial side must be taken into account. They might accept the principle that there was a type of electrode which was best for the particular job in hand, and that they must have a machine which would deposit that electrode. The bare electrode was very much cheaper than some of the heavy slag-depositing electrodes. Major Caldwell had referred to a particular type of plant, but there must be something deficient in it if it necessitated special devices for overcoming starting difficulties. The type of plant advocated in the paper presented no difficulties in starting, except with the small ranges of electrodes (such as 14 gauge bare electrodes), but even then there was a little difficulty in getting away. An inferior machine had been instrumental in condemning the use of a lightly-coated wire, for the reason that the machine was not able to deposit that type of wire and the contention was that the wire was not good; whereas, if they had had a decent machine, the welding would have been carried out quite efficiently. Welding had been successfully carried out on the a.c. system with as large a current as 600 amperes, using a 9/16 gauge rod, building up the wobler ends in one of the big steel works in this country. Only practical experience would tell which was the most efficient electrode for any particular job. Which plant was preferable, a.c. or d.c., could only be determined by weighing up portability, efficiency, and such considerations as the lay-out of the works.

Solving Equations.—Nature has obligingly furnished every inhabitant of this globe with a horizontal magnetic field for his use. Sailors use it to find the magnetic north, and now Dr. Alex. Russell and Mr. J. N. Alty, both of Faraday House, are using it to determine the real and imaginary roots of numerical algebraic equations. By arranging copper wires vertically and passing electric currents of given magnitudes through them, they find that the neutral points in the resulting magnetic fields give, not only the real roots of a given equation, but also the magnitudes of the real and imaginary parts of the imaginary roots. We do not know of any other practical method of finding these imaginary roots; radio telegraphists, who know that the periodic times and decrements of their oscillating circuits can only be found by determining the imaginary roots of certain equations, will be interested to know that these roots can always be found without the help of a mathematician.—*Faraday House Journal.*

Control Apparatus in Buildings.—The Electric Power Club (Cleveland, Ohio, U.S.A.), of which many of the leading American electrical manufacturers are members, has issued a list of specifications relating to control apparatus installed in public buildings. The points for which conditions are laid down include construction, erection, protection and other aspects of controllers for fan and pump motors, &c.

THE WORK OF THE ELECTRICITY COMMISSIONERS.

THE ANNUAL REPORT.

(*Continued from page 556.*)

Generating Plant—(*continued*).

The consents given during the year to 12 authorised undertakers and to 18 non-statutory undertakings in respect of new generating stations represented the initial installation of generating plant having a total rated capacity of 186,590 kW, thus exceeding the combined total for new construction and extensions sanctioned in the previous year.

The Commissioners have decided to give a brief account in their annual reports of the progress made in the construction of the more important new generating stations sanctioned by them from time to time:—

Agecroft Station (Salford Corporation) was sanctioned in June, 1922, and contracts were placed by the Corporation for plant of 30,000 kW. The station will be completed and the first generating set put into operation by the autumn of 1924.

Barking station (County of London Electric Supply Co., Ltd.) was sanctioned in June, 1922, and contracts have been placed for civil engineering works, steel frame buildings, generating plant (two 32,000-kW sets and two 15,000-kW sets), boilers, and switchgear, in each case after approval by the Commissioners. At March 31st, 1923, the Commissioners had given their approval for the execution of works representing a total capital expenditure of £694,603. The preliminary operations of constructing a new road and a new drainage system and river outfall works are practically completed; work on the foundations of the engine room and boiler house was begun in January, 1923, the whole of the excavation being already completed.

Barton station (Manchester Corporation) was originally authorised by the Manchester Corporation Act, 1914, but its commencement was delayed owing to the war. The construction of this station is in an advanced stage; the first two generating sets of 27,500-kW capacity, the first four boilers and switchgear are erected. Transmission lines from Barton to the three principal distributing centres have been established, and a supply from the Barton station will shortly be available.

Freemans Meadows central station (Leicester Corporation) was sanctioned in March, 1920, to contain 20,000 kW of generating plant. The first set was put on load in November, 1922, and the station formally opened in December of that year. Owing to the growth in the demand, the Corporation has recently decided to proceed immediately with the installation of the second 10,000-kW set.

North Wilford station (Nottingham Corporation) was sanctioned in September, 1920. Contracts for generating plant (three 10,000-kW sets) and for boilers and accessories were placed some twelve months ago; contracts have also been placed for foundations, steelwork, railway siding, switchgear, converters and transformers, ash conveyors, &c., and it is hoped to have the station ready for operation by the end of 1924.

Ribble station (Preston Corporation) was sanctioned in May, 1922, and contracts were placed for the generating plant (two 10,000/12,500 kW sets), &c., and for the construction of the station. The station will be completed by May, 1924.

Stourport station (Shropshire, Worcestershire and Staffordshire Electric Power Co.) was sanctioned in September, 1922. Contracts have been placed for buildings, specifications have been issued for generating plant, boilers, and mains, and preliminary drawings of the works for obtaining condensing water from the River Severn have been completed.

Extensions of Existing Generating Stations.

With regard to applications relating to the extension of existing generating stations, the Commissioners issued 74 consents during the year. Of this total, 68 consents were given to authorised undertakers and 1 to a railway authority, the remaining 5 being in respect of non-statutory undertakings. The sanctioned extensions represented in aggregate a plant capacity of approximately 235,740 kW, the division of the total as between various authorities being as follows:—Local authority undertakers, 113,200 kW; company undertakers, 87,000 kW; the railway authority, 15,000 kW; and non-statutory undertakings, 20,540 kW.

The question of the remodelling and extension of the Blackpool station formed the subject of a local inquiry, and in view of the probability of supplies being given from the station to other areas in the district, the Commissioners sanctioned the installation of two 5,000-kW sets.

The generating station constructed by the British Cellulose Co., Ltd., at Spondon during the war was acquired by the Derbyshire and Nottinghamshire Electric Power Co., in the latter part of 1922, and the Commissioners sanctioned the installation of an additional 12,000-kW set.

Reference has been made to negotiations entered into by the London Electric Supply Corporation with the South-Eastern & Chatham Railway regarding the supply of energy required by the Railway Co. for the electrification of its suburban lines. On being satisfied that a definite arrangement had been entered into with the Railway Co., the Commissioners sanctioned the installation of three 15,000-kW sets (25 cycles) at the Deptford station of the Supply Corporation for the purpose.

The Commissioners sanctioned the installation of a 12,500-kW set at the St. Marylebone station, and a 10,000-kW set at the West Ham Station; and a 15,000-kW set (33⅓ cycles) at Lots Road station, Chelsea, to meet the growing requirements of the London Underground Electric Railways.

The non-statutory undertaking of the Tees Power Station Co., Ltd., at Billingham, is operated for the purpose of supplying energy to the Newcastle-upon-Tyne Electric Supply Co., Ltd., and associated undertakings in the North-East Coast area. The Commissioners sanctioned the installation of an additional 20,000-kW set in the Billingham station.

A complete list of the consents issued by the Commissioners during the year is given in an appendix to the Report.

Private Generating Stations.

The Commissioners prescribed or approved the type of current, frequency, and pressure to be used at four new private generating stations.

Main Transmission Lines.

The number of applications made to the Commissioners during the year under review for consent to the establishment of main transmission lines bears evidence of the important preparations in hand for the further development of electricity supply, not only in connection with the schemes of reorganisation for various districts, but also as a result of the more extensive giving and taking of bulk supplies. Formal consents were issued in 22 cases. Many of these were for 33,000-volt cables, and one was for 66,000 volts, from the Dunston power station of the Newcastle-upon-Tyne Electric Supply Co., Ltd., to a sub-station at Bedlington, mainly overhead; this is the highest voltage so far sanctioned by the Commissioners.

Special Orders.

At the commencement of the period covered by this report, 31 applications for Special Orders were under consideration, six Special Orders made by the Commissioners on March 28th, 1922, being submitted on April 1st to the Minister of Transport for confirmation. During the year under review, 67 further applications were received. Particulars are given in an appendix. Of the 67 applications above-mentioned 29 were lodged by local authorities and 38 by companies.

A noteworthy feature of the applications made during the year was the extent to which there was competition between two or more applications in respect of the whole or a portion of the proposed areas of supply scheduled to the draft Orders, as many as 17 applications being thus affected.

During the year, the Commissioners made Special Orders in respect of 38 of the applications before them, all of which were submitted to the Minister of Transport for confirmation. One application was afterwards withdrawn by the promoters, leaving 59 applications still under consideration at the date of the report.

In the case of seven applications, the Commissioners found it necessary to give a hearing to the parties concerned or to hold a local inquiry before coming to a decision, and in certain other instances, the consideration of applications which had relation to electricity districts had to be deferred until the ultimate proposals for the district as a whole had been more fully defined.

An application was promoted by the Cumberland Waste Heat Owners Co., Ltd., the owners of a generating station from which supplies had been given for a number of years to certain mines in the Urban Districts of Egremont and Cleator Moor. The company had been asked to furnish supplies for lighting purposes in the districts in question, and had decided to extend its operations in this direction subject to statutory powers being granted. The two local authorities refused their consents to the granting of the Order, and the application was also opposed by several mine owners, by the Corporation of Whitehaven, and by the Rural District Council of Whitehaven. The Commissioners accordingly caused a local inquiry to be held into the matter in November, 1922, and from the evidence given it transpired (*a*) that the supplies for power purposes already being given by the company represented about 90 per cent. of the total demand in the two districts; and (*b*) that the refusals of consent and the objections were mainly based upon the possible formulation of a scheme for a joint undertaking for a large area, including the two dis-

tricts, which would be supplied from the generating station at Whitehaven.

After due consideration of all the evidence, the Commissioners were satisfied that the company was in a position to meet the requirements in the two districts on reasonable terms, and that it was in the public interest that the existing generating station should be utilised for the purposes of the districts. They also considered it extremely doubtful whether there would be financial justification for a scheme (as to which no definite application was before them) involving the construction of several miles of transmission line from Whitehaven through sparsely populated country in order to secure the comparatively small demand (other than for power purposes) remaining to be met in the two districts.

The Commissioners accordingly decided to dispense with the consents of the Urban District Councils of Egremont and Cleator Moor, to make the Order, and in pursuance of the provisions of Section 1 of the Electric Lighting Act, 1888, to make a Special Report to the Minister of Transport for presentation to Parliament, stating the grounds upon which they had dispensed with such consents. The Order had not been made at the date to which the report is made.

The Shropshire, Worcestershire and Staffordshire Electric Power Co. sought to be authorised to supply electricity for all purposes in certain districts situated within the area of supply under the Company's Power Acts of 1903 to 1919. The said districts were also situated within that portion of the South-West Midlands Electricity District for which the Power Co., under the scheme approved by the Commissioners, was to be generally responsible for electrical development. This was the first application before the Commissioners in which approval was sought in a Special Order for a method of charge as an alternative to the usual flat rate, the method by which the company desired to charge consumers for private house lighting and domestic purposes being as follows, namely, a service charge of 2s. 6d. per quarter for each room wired for the supply of electricity and, in addition, a charge of 3½d. for each unit of electricity supplied. The Commissioners decided to allow the application and to approve the method, and accordingly made an Order.

In the case of certain applications for Special Orders made by local authorities, powers were sought to authorise the sale of electrical apparatus and fittings, but no such provision has hitherto been allowed by the Commissioners in any Special Order made by them. The applicants in such cases were informed that it was the general policy of the Commissioners not to confer any powers with regard to electrical fittings beyond those conferred on Joint Electricity Authorities and local authority undertakers by Section 23 of the Act of 1919, and that any departure from such policy could only be considered in cases where strong and exceptional reasons were shown to exist.

Inclusive of certain Orders confirmed by the Minister of Transport during the period covered by the previous report, 42 Special Orders in all were submitted to and approved by Parliament during the year under review. A complete list of the Orders in question is given in an appendix.

Sanction to Borrowing by Local Authorities.

At the commencement of the period covered by this report, 65 applications from local authorities for sanction to borrowing for electricity purposes were still under consideration, and during the year 409 further applications were received. Sanctions either in full or in part were issued in 336 cases, three applications were refused, and 12 applications were either withdrawn or transferred to other departments where they involved borrowing for purposes not falling to be dealt with by the Commissioners, thus leaving 123 applications under consideration at March 31st, 1923.

The total amount of the loans sanctioned during the year was £7,923,656, as compared with £13,650,033 during the previous year, and £15,152,275 during the fourteen months from January, 1920, to March 31st, 1921. A list of the sanctions issued during the period April 1st, 1922, to March 31st, 1923, is given in an appendix. Of the total, 84 per cent. was for plant and mains, and 10.6 per cent. for buildings, &c.

Sanction to the borrowing of amounts to an aggregate of about £4,284,000 was sought by the 123 applications still under consideration at March 31st.

In seeking to draw any general conclusions from the preceding figures, regard must be had to the relative number of sanctions issued by the Commissioners in each period, and also to the variations that occurred in the cost of materials and rates of wages, the year ending March 31st, 1923, having witnessed a marked decrease in the latter items. Sanctions were issued to 181 local authorities during the year, and the reduced aggregate was largely attributable to the falling-off in the amounts sanctioned for buildings and civil engineering works and plant. Large schemes of extension formed the subject of fewer applications for loan sanction than in the previous two years; only one local authority received sanctions amounting in total to more than £500,000, namely the Corporation of Salford in respect of the construction of the new generating station at Agecroft. Sanctions amounting to £500,000 or over in each case were issued to five local authorities in the previous year, and to three local authorities during the preceding period.

Purchase of Land.

In November, 1922, the Ministry of Health issued a circular letter to local authorities in England and Wales on the subject of the acquisition of land. The letter indicated that it had become the practice of the Ministry to obtain the advice of the Valuation Department as to the value of land before a loan was sanctioned for its acquisition; that it was desirable that the advice of the Valuation Department should be obtained before local authorities submitted their proposals and that arrangements had been made whereby a local authority might obtain the advice of the district valuer for transmission with any such proposal. It falls to the Commissioners to sanction borrowing in the case of land proposed to be acquired by a local authority for electricity purposes, and to the Ministry of Health to decide as to the expediency of following the same procedure as that contemplated by the Ministry. The Commissioners came to the conclusion that uniformity of procedure was desirable even though the number of applications might be relatively small, and it was decided that procedure on the lines indicated should be followed in the case of future applications made to the Commissioners for such sanction.

Loan Repayment Periods.

By Section 29 of the Electricity (Supply) Act, 1922, the maximum period for the repayment of money borrowed after the passing of that Act by Scottish Local Authorities for electricity purposes was extended from 30 to 60 years. The maximum periods of 60 years in respect of freehold land and 50 years in respect of high-pressure trunk transmission mains already allowed by the Commissioners in the case of local authority undertakers in England and Wales thus becoming applicable to Scotland.

Suspension of Sinking Fund Payments.

During the year under review, several applications were made to the Commissioners for sanction to the suspension of sinking-fund payments, and sanctions were given in three instances. In the case of certain applications relating to the extension of undertakings, it appeared that the capital expenditure proposed to be incurred would be unremunerative for a certain period, but this fact alone was not regarded by the Commissioners as a sufficient reason for sanctioning the suspension of sinking-fund payments. Where the financial position of such an undertaking was likely to permit of normal provision for repayment being made from the date of borrowing without undue burden, the Commissioners have not authorised any suspension of the annual provision required to be made.

Unemployment Grants Committee.

As in the previous year, the Commissioners advised the Unemployment Grants Committee on applications made by local authorities for grants in respect of capital expenditure upon electricity supply schemes and extensions carried out for the relief of unemployment, it falling to the Commissioners to certify whether the proposed works were suitable works of public utility.

With regard to applications in which grants on the basis of 60 per cent. of the wages bill were sought, four cases were submitted by the Committee to the Commissioners for their observations. The Commissioners certified that the works proposed in each case were suitable works of public utility, and understand that the Committee decided to make grants in respect of three of the applications, involving an estimated contribution from State funds of £1,195 in all.

With regard to applications in respect of grants up to 50 per cent. of the interest (for a period of five years) on loans for which the repayment period was not less than 10 years, 47 cases were submitted by the Committee to the Commissioners during the year. One of these cases was referred to in the previous report, and of the remainder, 44 were approved by the Commissioners as involving suitable works of public utility. The Commissioners understand that the Committee decided to make grants in respect of 33 of the applications, the estimated capital expenditure on the works contemplated under these applications amounting to £337,449 in all.

(To be continued.)

New Science Museum.—Engines of all ages and other mechanical novelties, which for many years have been stored in the cellars of the Science Museum at South Kensington, will soon be on view again. One gallery of the new building in the Exhibition Road, begun for the science exhibits before the war, then given over to the Savings Bank Department, and now restored to its original purpose, will be opened in a few weeks and the main galleries, it is hoped, early next year. —*Daily Mail.*

Finsbury Old Students' Association.—The twelfth annual dinner will be held at the Engineers' Club on November 10th, when the chair will be taken by the president, Mr. W. M. Mordey, M.Inst.C.E., M.I.E.E., at 7 p.m. Tickets, 10s. 6d. each, may be obtained from the Hon. Secretary, Mr. H. P. Guy, 74, Silver Street, Edmonton, N.18.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A "Best" Electric Fire.

Among the many fires which are illustrated in a catalogue recently issued by Messrs. Best & Lloyd, Ltd., Cambray Works, Handsworth, Birmingham, is that depicted in fig. 1. This is of a type particularly adapted for all-round heating, and can be placed in the centre of a room. The six elements are spaced at equal distances and are protected by wire guarding. Each element has a 500-W loading and is constructed on a special principle patented by the firm. The fire-bar has staggered triangular projections moulded upon it and

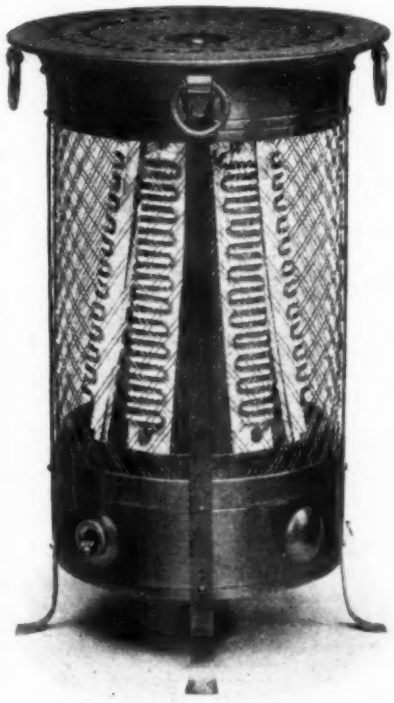

Fig. 1.—A "Best" Electric Fire.

the nichrome wire spiral is sunk between these projections, the turns being covered over.

The fire illustrated has a height of 21 in. and the diameter of the top is 13 in. There are two control switches of the simple tumbler pattern. The fire is produced in either of two finishes—oxidised brass or oxidised copper.

"Sunco" Electric Fires.

Among the new designs of electric fires which have been produced by the Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2, is that illustrated in fig. 2. This is an "Adams" model fitted with two 500-W bars of a curved shape

Fig. 2.—A "Sunco" Fire.

to give a widely distributed radiation. The fire is 12½ in. wide and 9¾ in. high, and it weighs about 14½ lb. It is produced in three finishes, *viz.*, glazed black enamel with antique silver ornamentation, sanded brass, and armour bright, with antique silver applied ornaments.

Dry Batteries for Dull-emitter Valves.

Messrs. A. H. Hunt, Ltd., Tunstall Road, Croydon, have recently placed on the market a type of "Hellesen" dry battery designed especially for supplying current to the filaments of dull-emitter valves. Four sizes are made, as follows:—1.5 V, 60 and 130 Ah; 3.0 V, 60 and 130 Ah. Assuming that the filament current is .25A, and the average weekly use 15 hours, it will be seen that the smallest size will have a "life" of 16 weeks.

A Commutator Grinding Stone.

In view of the cost of dismantling large generators, or even the smallest motors, to turn the commutators of the armatures true, a commutator grinding stone recently brought to our notice appeals to us as being one of the best methods introduced of avoiding the heavy costs of dismantling machines and reassembling. This grinding block, which is illustrated in use in fig. 3, is made by Messrs. Hurry Bros., of Greenock, and Collins Electrical, Ltd., is the London and export agent for the block.

The block is made of a compound which does not make the copper drag or stick to it, and which effectively cuts the copper so fine as to distribute it in a powder, and the windage of the running machine disperses the particles and enables the stone to be used whilst the machine is working. The stones are made in three grades, *viz.*, rough for commutators badly grooved to grind quickly; medium for commutators which are grooved slightly; and a polishing stone to put a fine surface on the commutator. These stones have been in use now for a matter of eight years, and have proved themselves to be exceedingly useful. They are being used by practically

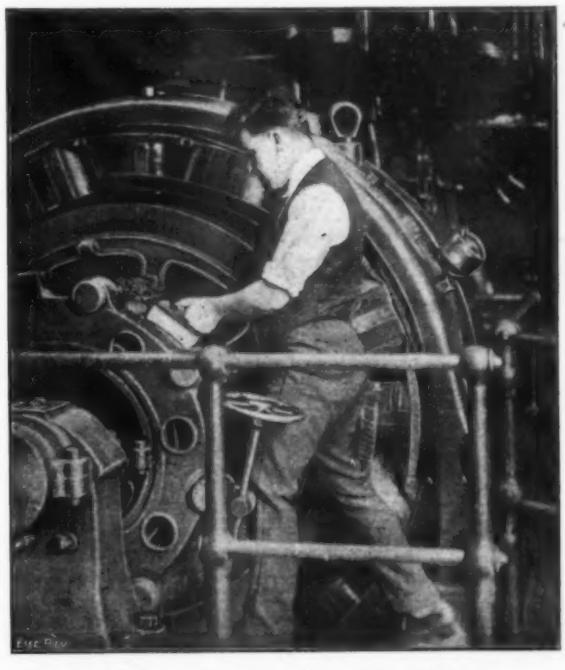

Fig. 3.—Commutator Grinding Stone in Use.

every large station in the country, and a large order was recently received from the Lotts Road (Underground) power station.

The wooden tops or handles are made of a cheap grade of wood to avoid all unnecessary expense, and when the stone itself is finished, the top of the block can be scrapped. Collins Electrical, Ltd., has used these stones successfully in its large repair works and on large station work for a considerable time, and has thus on many occasions avoided the cost of taking machines away to be turned up.

A Hole-boring and Pole-erecting Machine.

The note bearing this heading in our issue of September 28th stated that one of these machines had been supplied to the Post Office. This was not strictly correct as the Post Office authorities are merely hiring the machine from the maker, Mr. Ernest Hole, Mill Road, Burgess Hill, Sussex.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

24,318. "Frame aerials for wireless telephony, &c." H. W. Cole. October 1st.

24,326. "Electric condensers for wireless telegraphy, &c." F. H. Blaxley. October 1st.

24,346. "Electric contact breakers." A. Orling. October 1st.

24,362. "Electrical coil." W. L. Denton and G. A. Horton. October 1st.

24,413. "Electric lamps for motor cars." G. McCulloch. October 1st.

24,423. "Rubber caps for telephone receivers." F. Tidy. October 2nd.

24,424. "Reproducers or microphones for gramophones, &c." C. A. Baker. October 2nd.

24,432. "Antiseptic lining for telephone mouthpieces." T. J. Southall. October 2nd.

24,441. "Device for operating electric horns of motor-cars." W. S. Dimes. October 2nd.

24,448. "Distributors or switch mechanisms for controlling electric circuits." F. H. Grove. October 2nd.

24,453. "Device for indicating condition of battery." Austin Motor Co., Ltd. October 2nd.

24,455. "Recording apparatus for wireless messages." C. Kratt. October 2nd.

24,466. "Frame aerials for wireless apparatus." W. J. Davis. October 2nd.

24,468. "Radio-repeating systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). October 2nd.

24,485. "Magneto machines." G. Hunter. October 2nd.

24,488. "Electric traction systems." Sir J. A. E. Aspinall and English Electric Co., Ltd. October 2nd.

24,491. "Control of synchronous electric motors." British Thomson-Houston Co., Ltd., and F. P. Whitaker. October 2nd.

24,498. "Electric lighting and ignition machines for motor vehicles, &c." F. L. Hollister and C. A. Vandervell & Co., Ltd. October 2nd.

24,510. "Electric starters." Bayerische Elektrizitats-Industrie Rott & Co. October 2nd. (Germany, October 2nd, 1922.)

24,520. "Micrometer variable condenser." H. Brantom. October 3rd.

24,521. "Method of transmitting capacity currents in underground cables." A. M. Taylor. October 3rd.

24,543. "Road-illuminating means for motor vehicles." G. H. Tonks. October 3rd.

24,555. "Electric light fitting." A. J. Beale and W. H. Edey. October 3rd.

24,566. "Electrolytic cells with mercury electrodes." G. T. Beilby. October 3rd.

24,579. "Sparking-plug valves." Bolinders Meckaniska Verkstads Aktiebolag, J. & C. G. October 3rd. (Sweden, October 14th, 1922.)

24,587. "Apparatus for cleaning tramway rails." E. L. Champion and A. A. G. H. Terriss. October 3rd. (France, November 25th, 1922.)

24,596. "Dynamo-electric machines." F. L. Hollister. October 3rd.

24,597. "Telephone apparatus." Radiotive Co. October 3rd. (United States, January 31st.)

24,606. "Lifts, &c." Dixon, Powner & Sons, E. Powner and W. Powner. October 3rd.

24,613. "Insulating material." British Thomson-Houston Co., Ltd. (General Electric Co.). October 3rd.

24,614. "Electric motor control." British Thomson-Houston Co., Ltd., and H. C. Hastings. October 3rd.

24,662. "Lighting motor vehicles." T. Butcher. October 4th.

24,668. "Electric junction boxes, &c." O. Ekman. October 4th.

24,680. "Electric locking devices for railway carriage doors." R. W. Horsfall. October 4th.

24,693. "Receiving apparatus for wireless telegraphy." L. J. Goldhill, H. M. Linden, L. P. Linden, and Wedekind & Co. October 4th.

24,699. "Wireless receiving apparatus." T. E. Webster and W. S. Worthington. October 4th.

24,709. "Electric storage batteries, &c." E. E. Eakins. October 4th.

24,712. "Telephone systems." W. Carnell and Coventry Automatic Telephones, Ltd. October 4th.

24,713. "Telephone systems." J. E. Collyer and Coventry Automatic Telephones, Ltd. October 4th.

24,738. "Control of electric motors." Metropolitan-Vickers Electrical Co., Ltd. October 4th. (United States, October 4th, 1922.)

24,748. "Connections for oscillatory electric circuits." F. W. Wallis. October 4th.

24,750. "Apparatus for closing automatic electric switches." Akt. Ges. Brown, Boveri et Cie. October 4th. (Germany, October 9th, 1922.)

24,752. "Damping devices for vibratory apparatus." Signal Ges. October 4th. (Germany, October 18th, 1922.)

24,767. "Variable resistance and potentiometer." F. E. Stratten. October 5th.

24,810. "Electromagnetic sound transmitters and receivers." A. F. Sykes. October 5th.

24,815. "Electrical apparatus for generating ozone." J. McBlain. October 5th.

24,819. "Automatic telephone systems." Western Electric Co., Ltd. (Deakin). October 5th.

24,835. "Electric light fittings." J. H. Collings and S. D. White. October 5th.

24,855. "Devices for indicating faults in ignition systems of internal-combustion engines." E. Schattner. October 5th.

24,856. "Alternating-current circuits." Ges. für Drahtlose Telegraphie. October 5th. (Germany, October 13th, 1922.)

24,857. "Telephone trunking schemes." Relay Automatic Telephone Co., Ltd., and E. J. C. Rousseau. October 5th.

24,858. "Method of regulating speed of high-frequency alternator." Soc. Française Radio-Electrique. October 5th. (France, October 9th, 1922.)

24,860. "Glow cathode X-ray tubes." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 5th.

24,861. "Electric condensers." L. F. Barnes and Telephone Manufacturing Co., Ltd. October 5th.

24,874. "Wireless telephone receiver." W. J. Taylor. October 6th.

24,900. "Wireless receiving sets." G. A. Mitchell. October 6th.

24,901. "Wireless transmitting and receiving sets." G. A. Mitchell. October 6th.

24,902. "Incandescent electric illumination." A. T. Davies. October 6th.

24,908. "Attachment for distributing electric current for lighting on roundabouts, &c." E. E. Scott and R. W. Scott. October 6th.

24,911. "Manufacture of table salt in conjunction with electrolysis of salt solutions." E. G. R. Angel. October 6th. (Sweden, October 6th, 1922.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

8,013. "Alloys of molybdenum with chemical, mechanical, and electric qualities." Norske Molybdenprodukter Aktieselskabet. March 26th, 1923. (177,516.)

8,306. "Electric lamps, more especially for road vehicles." A. A. Sandbrook. March 22nd, 1922. (204,072.)

13,905. "Telephone instrument circuits." British L.M. Ericsson Manufacturing Co., Ltd., and W. M. Crowe. May 17th, 1922. (204,084.)

14,426. "Fusible cut-outs for electrically-heated articles." C. E. Ireton. May 22nd, 1922. (204,087.)

15,426. "Construction of anti-dazzle head lamps for motor and other vehicles." R. I. Atherton. July 18th, 1922. (204,090.)

15,495. "Electric motor controllers." C. L. Browne and S. H. Heywood and Co., Ltd. March 2nd, 1923. (204,091.)

15,961. "Apparatus for projecting advertisements on to a screen." J. E. H. Crawford and E. Lawson. January 29th, 1923. (204,092.)

16,626. "Electrically-operated valves." L. Miller, J. P. Campbell, F. R. Holt, and Metropolitan-Vickers Electrical Co., Ltd. June 15th, 1922. (204,094.)

16,804. "Devices for detecting and locating masses of dissimilar electric conductivity in the earth." Erda Ges. für Wissemschaftliche Erderforschung and Dr. R. Ambronn. June 17th, 1921. (181,731.)

16,893. "Systems of electric motor control." British Thomson-Houston Co., Ltd., H. C. Hastings, and G. O. Watson. June 19th, 1922. (204,105.)

16,947. "Automatic electric current regulators." W. Langdon-Davies and A. Soames. June 19th, 1922. (204,109.)

17,051. "Recording apparatus for meters." Landis & Gyr Akt. Ges. June 20th, 1921. (182,115.)

17,069. "Automatic and semi-automatic telephone switching systems." W. Aitken. June 21st, 1922. (Cognate application 20,181/22.) (204,118.)

17,095. "Apparatus for wireless signalling and like purposes." A. Oswood. June 21st, 1922. (204,119.)

17,121. "Dynamo-electric machines." G. McAlpine and A. K. Toulmin-Smith. June 21st, 1922. (204,123.)

17,337. "Oil-immersed electric switches, circuit breakers, and the like." W. A. Coates and Metropolitan-Vickers Electrical Co., Ltd. June 23rd, 1922. (204,127.)

17,359. "Wires for sealing into glass and the like." British Thomson-Houston Co., Ltd. (General Electric Co.). June 23rd, 1922. (204,130.)

17,513. "Electrical inductances." W. A. McKillop and W. A. Brooke. June 26th, 1922. (204,136.)

17,562. "Radio meters." S. Russ and L. H. S. Clark. June 26th, 1922. (204,137.)

17,889. "Electric switches." I. Calvete. June 29th, 1922. (Addition to 153,787.) (204,146.)

18,113. "Electrically-operated indicators for theatres, picture palaces, and the like." C. Lawson. July 1st, 1922. (204,148.)

19,122. "Electrical controllers." R. Amberton. July 12th, 1922. (204,158.)

19,531. "Electrophorus gas lighter." E. Zipperle. July 15th, 1922. (183,142.)

19,868. "Electric power transmission systems." A. M Taylor. July 20th, 1922. (Patent of addition not granted.) (204,167.)

19,975. "Electrical heating means for fuel for internal-combustion engines." W. M. Harrison. July 20th, 1922. (204,169.)

20,601. "Telephone exchange systems." Western Electric Co., Ltd., and G. Deakin. July 27th, 1922. (Cognate application 30,113/22.) (204,176.)

21,004. "Buffing and draw gear for railway, tramway, and like vehicles." A. Spencer. August 1st, 1922. (204,181.)

22,000. "Transformer arrangements particularly adapted for high-frequency telephony systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 12th, 1922. (204,185.)

22,220. "Method and apparatus for establishing high-voltage electric circuits, comprising removable hand contact-making devices." C. Dachary and L. Viguier. January 28th, 1922. (192,358.)

23,530. "Electric cooking utensils." Magnum Ges. and H. Endres. August 30th, 1922. (204,193.)

24,274. "Galvanic batteries." Oldham & Son, Ltd., and J. Oldham. September 7th, 1922. (204,198.)

25,105. "Electrically-heated kettles and similar vessels." Hague and McKenzie, Ltd., and A. Hague. September 16th, 1922. (204,206.)

25,269. "Apparatus for indicating the number of vacant seats on the top of tramway vehicles or the like." R. McGown. September 18th, 1922. (204,209.)

27,595. "Induction motors." Ateliers H. Cuenod, Soc. Anon. October 18th, 1921. (187,595.)

28,032. "Electric light globe attachments." E. W. Hutchings. October 18th, 1921. (187,602.)

29,439. "Method of manufacture of glass caps moulded under pressure for incandescent electric lamps and similar apparatus." L. S. Vello. October 29th, 1921. (187,999.)

30,739. "Means for supporting filaments or filament leads in thermionic tubes or valves." L. G. Preston, H. G. Hughes, and A. L. Kirkham. November 10th, 1922. (204,237.)

33,359. "Earthing choking coils or voltage transformers for high voltages." E. Pfiffner. December 6th, 1921. (Addition to 173,759.) (190,154.)

1923.

6,613. "Long-distance telephony over submarine cables and other long conductors." B. E. D. Kilburn (Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij). March 7th, 1923. (204,270.)

8,675. "Device for mechanically rectifying high-tension polyphase current." Lodge-Cottrell, Ltd. (Metallbank und Metallurgische Ges. Akt. Ges.) March 27th, 1923. (Addition to 185,891.) (204,276.)

10,295. "Electric pocket lamps." G. Cailler. April 15th, 1922. (196,220.)

Gas Progress.—At the annual conference of the British Commercial Gas Association at Birmingham recently, reported in *The Gas World*, Mr. F. W. Goodenough, executive chairman, stated that the sales of gas had shown a larger increase in every successive quinquennial period during the last 20 years, amounting to 14 per cent. in the period 1917-22. Evidently, therefore, the rapidly extending use of electricity is not seriously hindering the progress of the gas industry, and there is room for both these factors of modern civilisation.